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# H.R. 5000—RECYCLABLE MATERIALS: PLASTICS IN THE ENVIRONMENT

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## HEARING

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT

OF THE

## COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
## U.S. HOUSE OF REPRESENTATIVES

ONE HUNDREDTH CONGRESS

SECOND SESSION

AUGUST 10, 1988

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# H.R. 5000—RECYCLABLE MATERIALS: PLASTICS IN THE ENVIRONMENT

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WEDNESDAY, AUGUST 10, 1988

House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on Natural Resources, Agriculture
Research and Environment,
*Washington, D.C.*

The subcommittee met, pursuant to call, at 9:35 a.m., in Room 2325, Rayburn House Office Building, Hon. James H. Scheuer [chairman of the subcommittee] presiding.

Mr. Scheuer. Good morning.

The Subcommittee on Natural Resources, Agriculture Research and Environment will come to order.

Today we will consider, not only an important bill, but a bill that could be critical for the future of our country and the quality of life of our country, the Recyclable Materials Science and Technology Development Act. I assure you that none of the garbage that we're trying to collect will be as unwieldy and difficult to manage as the title of this bill.

Nevertheless, the sub—however unwieldy the title may be, the substance of the bill is clear and is unmistakable and it's right. And it's sponsored by my distinguished colleague from New York, from Long Island, the Honorable George Hochbrueckner.

We'll also, after hearing about Congressman Hochbrueckner's program, we'll hear about a new technology, the technology of degradable plastics, the technology of designing a packaging material so that within six months or a year of its use, it will degrade; it will disappear, either as the result of exposure to sunlight or exposure to various microbial processes. It will disintegrate, and not live to plague us, to poison our land, to enormously increase the burden of our garbage, to fester in the oceans, choking fish and generally providing an incredible environmental burden and hazard on the land and in the sea, and, if you try to incinerate it, in the air as well.

I'm very proud to say that my colleague from New York has given us the first bill aimed at developing a comprehensive national strategy on the recycling of our growing wastes. They are about to envelop us in an avalanche of waste.

George Hochbrueckner, of Long Island, has had a record of clear leadership in this field. Before coming to Congress, he served for eight years as Chairman of the Resource Recovery Subcommittee of the New York State Assembly, and he has led New York's efforts to get out in front in the solid waste disposal problem that threatens to engulf us.

We're delighted that he has continued to provide leadership to the nation, as he did for New York State, on this growing issue that every single community in our land will have to face up to sooner or later.

Today's hearing is the first in several that this subcommittee will undertake in an effort to explore technologies and other solutions to the garbage crisis. We are literally drowning in an avalanche of plastics and other forms of trash.

America's throw-away society generates nearly—now listen to this—200 million tons, almost a million tons of garbage for every man, woman and child in this country. Imagine that. We're a population of 242 million and we develop 200 million tons of garbage every year, almost a million tons for every man, woman and child. And we're running out of space in which to put this garbage.

Over the next several years, two-thirds, half to two-thirds of our States will face critical landfill capacity problems. Plastic trash poses a particularly severe problem because although plastics have been with us only 40 years, now they're everywhere. They're washing up on our beaches; they're strangling our marine wildlife; they're filling up our landfills and they're littering our roadsides.

And it is costing us an infinity more to remove garbage from amongst us, pull it out of our environment, than it did to—than it cost originally to manufacture the plastic containers that are providing such a plague.

We'll need to look at a whole range of technology and options to solve the garbage problem. Waste reduction, recycling, resource recovery, land disposal and degradable plastics are all likely to play a role in the—in a comprehensive and multidisciplinary approach to this problem.

The new technology that may help us address this problem is already here: plastics that degrade under the action of the sun or by microbial action, as I mentioned before, are already—they've already been designed; they've been manufactured and they're in use all over the world. And many of the plastic products which we use today can be made biodegradable.

Today we'll examine the potential of this exciting new technology to solve some of the plastic pollution problems that engulf us. We'll also look at some of the questions that have been raised about biodegradable plastic, such as the relationship between recycling and degradability and any potential effects that these degradable materials may have on human health or the environment.

We also wish to consider the role of government in promoting these technologies and in implementing policies that promote recycling and use of degradable materials.

I expect that we're going to learn a great deal in this series of hearings and hope that they can help direct American industry and American consumers into more environmentally responsible actions and policies.

Now, I will recognize the ranking member of this committee, who has been so deeply involved in the problems of environment, Claudine Schneider, of Rhode Island, as soon as she appears.

[The prepared opening statement of Hon. Claudine Schneider follows:]

# REPRESENTATIVE CLAUDINE SCHNEIDER
# OPENING STATEMENT
# HEARING ON PLASTIC POLLUTION
# AUGUST 10, 1988

SOLID WASTE DISPOSAL HAS BECOME A MAJOR PROBLEM FOR STATE AND LOCAL GOVERNMENTS IN THE U.S. AMERICANS GENERATED 150 MILLION TONS OF SOLID WASTE IN 1984, AND THE AMOUNT IS RISING. MEANWHILE WE ARE RAPIDLY RUNNING OUT OF LANDFILL CAPACITY IN MANY URBAN AREAS.

THE AMOUNT OF PLASTIC THAT WE PRODUCE IS ENORMOUS AND GROWING. FURTHERMORE, ABOUT 95% OF PLASTIC THAT IS PRODUCED ENDS UP BEING DISCARDED. ACCORDING TO ONE ESTIMATE, PLASTICS REPRESENT OVER 7% OF SOLID WASTES BY WEIGHT AND OVER 30% BY VOLUME.

PLASTIC OBJECTS ARE ALSO A MAJOR PROBLEM IN THE OCEANS, WHERE MARINE ANIMALS EAT THEM OR BECOME ENTANGLED IN THEM. ON MY OTHER COMMITTEE, THE MERCHANT MARINE COMMITTEE, I HAVE STRONGLY SUPPORTED EFFORTS TO REMOVE THE THREAT OF PLASTIC POLLUTION TO MARINE LIFE.

RHODE ISLAND IS NO DIFFERENT THAN OTHER STATES IN THE SEVERITY OF THE PLASTIC POLLUTION PROBLEM THAT IT FACES. HOWEVER, RHODE ISLAND IS DIFFERENT INSOFAR AS IT IS ONE OF THE FEW STATES THAT HAS ADOPTED A STATEWIDE SOLID WASTE DISPOSAL PROGRAM, THE FLOW CONTROL LAW OF 1986.

THIS LAW ESTABLISHES A STATEWIDE GOAL OF A REDUCTION OF 15% IN SOLID WASTE. REDUCTIONS WILL BE ACHIEVED MAINLY THROUGH REDUCTIONS IN THE GENERATION OF WASTES AND AN INCREASE IN RECYCLING.

EARLY RESULTS OF A PILOT PROJECT ON COLLECTION AND RECYCLING ARE ENCOURAGING. IN WEST WARWICK AND EAST GREENWICH, 14.5% OF THE WASTE STREAM WAS COLLECTED FOR RECYCLING OVER A FIVE MONTH PERIOD. PLASTICS CONSTITUTED OVER A THIRD OF THE WASTES THAT WERE COLLECTED BY VOLUME. A MAJORITY OF THE RESPONDENTS TO A PRIVATE SURVEY SAID THAT SEPARATING RECYCLABLES REQUIRED ONLY A SLIGHT AMOUNT OF EXTRA EFFORT.

THUS, THERE IS MUCH THAT CAN ALREADY BE DONE ABOUT PLASTIC POLLUTION GIVEN SUFFICIENT COMMITMENT AND THE RIGHT MIX OF PRIVATE AND GOVERNMENT CONTRIBUTIONS. HOWEVER, IT IS POSSIBLE THAT EVEN MORE CAN BE DONE SPECIFICALLY THROUGH THE USE OF DEGRADABLE PLASTICS, THE SUBJECT OF TODAY'S HEARING.

I AM INTRIGUED BY THIS PROSPECT AND LOOK FORWARD TO THE TESTIMONY THAT WILL BE OFFERED BY OUR PANEL'S EXPERTS. AT ONE TIME OR ANOTHER, I AM SURE WE HAVE ALL WISHED THAT WE COULD JUST MAKE UNSIGHTLY PLASTIC POLLUTION DISAPPEAR. PERHAPS FULFILLING THIS WISH IS A MORE REALISTIC POSSIBILITY THAN WE REALIZE.

Mr. SCHEUER. In the meantime, I'm going to recognize the sponsor—the original sponsor of this bill and the man who has given so much national leadership to this urgent cause, Congressman George Hochbrueckner of the State of New York.

Mr. HOCHBRUECKNER. Thank you, Mr. Chairman.

I have a couple of charts and just a brief presentation and I think I'll do it right from over here, if that is okay with you.

The problem that we face with garbage is that we have a mixed bag, and I think as most people know, the average contents of landfill roughly breaks down into this kind of combination. About 37 percent of our garbage, our waste stream, is paper and paperboard and, of course, that can be recycled, along with some composting. We have—30 percent of our waste stream is full wood and yard wastes, which are amenable to composting approaches. Six percent is rubber, textiles and miscellaneous. Seven percent is plastics, and that number, of course, is increasing dramatically. Ten percent is metals and 10 percent is glass. And, of course, there are recycling, as well as other approaches that can be taken in order to properly deal with the waste stream that we, as a very rich nation, produce.

We certainly produce—we have used our high technology and our capabilities to produce a variety of consumer products and, of course, with that, we have also produced a variety of consumer product packaging which is causing us great concern in terms of the amount of waste we produce and also, of course, its type.

So the effort is obviously to deal with the problem, and I think certainly the chairman has well addressed the problem as it does exist today. Clearly, we need to deal with it. Over 200 million tons of garbage per year in the United States is an incredible amount of resource that, in fact, can be reused in many cases.

And certainly it's appropriate that from Long Island, where the famous or infamous garbage barge came from, it's appropriate that we also come with a solution from Long Island, which is where I'm from, with H.R. 5000.

And, of course, H.R. 5000, as the chairman pointed out, is the Recyclable Materials Science and Technology Development Act—try saying that fast three times—but nevertheless, it makes the point in the name in terms of what we're trying to accomplish. Certainly its basic goal is to reduce the quantity of our garbage and to change its composition. That's the dual goal of the bill.

Essentially, this is what the bill will do. It's a five-year program with very specific targets as we march through those five years. For example, by month 6, the Agriculture Department is directed to start a compost project. The Commerce Department, which will do most of the work under this bill, is directed to open an Office of Recycling Research and Information and would be granted up to $10 million that they could let in grants for the purpose of, I would think, basically encouraging, through our private industry, the development of recyclable materials and, of course, the goal being that overall, we would come up with a list from the Commerce Department with the EPA approval which would define which items would be recyclable. Those which are not recyclable would be required to be photo- or biodegradable and there would also be some items that would be exempt from this process.

So by the end of year 1, the Agriculture Department must report on its composting experiments so that there are many opportunities for composting; many items in our waste stream. We need to encourage composting to a great degree.

By year 2, the Commerce Department reports on recycling degradable and also the possibility of antiwarning labels so that if a particular item is not either recyclable or degradable for whatever reason, then we would consider the possibility of putting warning labels on that that would advise consumers that this product will probably end up in a landfill, so if they're going to choose between a consumer product, some packaging that, in fact, will be degradable versus something that will end up in a landfill, they would be encouraged to buy the item that, in fact, is recyclable or degradable, as opposed to something that will end up in the waste stream.

And so, also, the Health and Human Services Department is required to examine all medical items to decide in terms of syringes and bottles and other items that hold medicines which of those items should be required to be recyclable, which should be degradable, which should be exempt.

And, of course, the Defense Department, which is a major spender—$299.5 billion—is a major purchaser of items in this nation—they would also be required to see how they could, in fact, cozy up to this law.

By year 4, the Commerce Department, in conjunction with the EPA, would, in essence, develop this list of items and they would define that certain items must be recyclable; other items must be degradable, and they would also define the list of items that would be exempt.

And so, in the fifth year, that particular list would become mandatory; that this is what you must do with your shampoo bottles and your soda bottles and everything else. And Congress will issue this list of recyclables, degradables and exempt items.

Also, the bill would require that certain items would be mandatorily required to be degradable, and this would include six-pack rings, for example, plastic shopping bags and also the—the restaurant fast-food type of packaging, the polystyrene and other items would be required—it would be mandated that they must, in fact, be degradable.

And, of course, there would also be penalties involved, and this is similar to other sections of the law.

So the idea is by this five-year comprehensive program, and this is the most comprehensive waste program that has, in fact, been introduced at the Federal level. It would require, through this five-year program, a variety of actions to take place which we believe will take the entrepreneurial and the inventive skill of the people of the United States, which has been so productive in producing this tremendous amount of waste, to, in fact, use that same capability to provide ways to properly dispose of all waste.

So the goal of this five-year comprehensive bill, H.R. 5000, again is to reduce the quantity of our waste stream and also to change its composition so that we, as a nation, can better deal with the waste that we produce.

With that, Mr. Chairman, I thank you and my colleagues for your indulgence and I'm delighted to hear from my other colleagues and the input that we will have on this very important area of photo- and biodegradable plastics.

Thank you.

Mr. SCHEUER. All right. Now we'll hear from our congressional friends out there.

Mr. COURTER. Mr. Chairman, if you indulge me, before we do, could I just ask George one quick question?

Mr. SCHEUER. But of course.

Mr. COURTER. I found with interest the first chart, typical landfill and the percentage of those items in it. Where did you get—because landfills differ so much, I guess, depending on what part of the country, et cetera—where did you get those statistics?

Mr. HOCHBRUECKNER. This was data based on a 1984 survey by Newsday on Long Island, so it's a typical East—

Mr. COURTER. Long Island.

Mr. HOCHBRUECKNER. —Coast kind of combination of garbage.

Mr. COURTER. Thank you very much. Thank you, Mr. Chairman. Appreciate it.

Mr. SCHEUER. Now we'll hear from our colleague, Paul Henry, and then we'll go on. Congressman Henry.

Mr. HENRY. Thank you, Mr. Chairman. I wanted to be here this morning just to give my encouragement to the gentleman for his bill, as he knows I'm a cosponsor of that legislation.

I have amendments pending at 10:00 in the child care mark-up in Education and Labor Committee, so I have to leave, but I wanted to be here for the opening statements, because I believe so strongly in this legislation.

The chairman pointed out we're producing nearly a ton of solid waste per citizen each year. The figures are even more alarming when we get into hazardous waste where we're producing more than a ton per citizen each year.

If I would add one brief comment to my colleague on his proposal, a proposal which I have cosponsored and which I fully support, it would be seeking ways in which we could streamline that schedule in such a way that regardless of what administration we have next year, whether it's a Bush Administration or a Dukakis Administration, we're able to get this bill through the legislative calendar and get accountability in that first term for implementation of this kind of legislation.

If there's any way to squeeze five years into three-and-a-half so you can hold an administration, no matter who it is, accountable for the implementation of this kind of legislation, which I'm convinced is going to be adopted by the Congress, I would commend the gentleman to do so.

Thank you, Mr. Chairman.

Mr. HOCHBRUECKNER. Mr. Chairman, if I could make just a quick response.

First off, I would like to respond and thank you for your sponsorship. I'm very pleased to say that to date I have 45 cosponsors from both Democratic and Republican sides of the aisle and I'm delighted about that, and also, when we first started our research on this project last fall, we started with a 10-year program and have shrunk it to five. I'd be delighted to shrink it even more if that is achievable. Thank you for your comment.

Mr. SCHEUER. Congressman Tom McMillen.

Mr. McMILLEN. I have no comments, Mr. Chairman.

Mr. SCHEUER. Okay.

Now we go to our congressional group. Why don't we start on your left, my right.

Congressman Jim Courter, of the neighboring State of New Jersey, where they are suffering such a plague of inundation of refuse, especially plastics and other waste coming out of the sea.

We're delighted to have you and all of the expertise you've accumulated facing up to this problem in New Jersey addressing us this morning.

Congressman Courter.

## STATEMENT OF HON. JIM COURTER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. COURTER. Thank you very much, Mr. Chairman, Mr. Hochbrueckner and Mr. McMillen and other people on the panel. I appreciate the opportunity to testify.

I am just going to summarize basically my testimony. We've obviously become a throw-away society. There's more things that we get rid of now than ever before. Mr. Hochbrueckner talked about that.

We all know that the solid waste stream is getting larger, tons and tons and thousands of tons of garbage. The innovations in packaging certainly make our life a good deal easier, yet the byproducts of the conveniences—the paper, the metal, the plastics, the ceramics, the aluminum are causing large problems in the municipal waste stream.

It is clear that we need to reduce the amount of trash being generated, and I support certainly most of the provisions and the major thrust of H.R. 5000 that would study ways to recycle and ways to biodegrade our products. I do not believe that we should jump into new technology, however, without first considering the impact new types of mandated programs on biodegradability have on our environment. Sometimes too little is known about the compounds and what they may do.

Plastics are comprised—for example, that's a particular concern of mine and I know that Mr. Hochbrueckner and I have an interest in recycling plastics and making plastics safer, and reducing the amount of plastics in our waste stream that is nonbiodegradable, but plastics are comprised of lots of things, including polymers. Some of those polymers include the benzene and propane gas that are unstable materials made chemically stable when made into plastics. When we degrade those molecules, we are breaking them down into smaller pieces.

When we do this, we run the risk of creating chemically reactive materials. This, in turn, could produce land, water, and air pollution.

Additionally, concerns have been raised about premature failure of the package and the possible contamination of contents when using degradable plastics. Biodegradation is a slow process that requires moisture and burial.

I noticed with interest that some of the landfills that we have in New Jersey—when you dig them up, you can actually read newspaper print, even though the paper has been in the landfill for 20 years, showing that paper, obviously, is biodegradable, but when you get it in a hermetically sealed environment with no light, with no moisture, with no air, even that which is biodegradable ends up not to be so because of the general compacting and type of landfill that you have.

In short, I believe that biodegradable plastics would address the litter problem clearly. If you threw a biodegradable Coke bottle to the side of the road, I suppose in a matter of weeks, if it was subject to rain and light and heat and temperature and wind, it wouldn't be there any longer, but the properties and components of that which it contained would be into the environment and perhaps eventually go into the groundwater.

Also, the use of these plastics makes it harder to recycle the very product that needs to be recycled.

I don't think we can recycle all plastics. Clearly, we can't. I didn't even realize that a number of years ago, that plastics were recyclable, but they are.

New types of plastics that are biodegradable could, by their definition, not be recyclable, and therefore, the recycling effort of plastics, which is an important one, may be jeopardized.

I think that before we jump into what looks like the easiest solution to a mounting problem, we must explore all the aspects of that problem. We have in New Jersey—and other States do as well, and I wouldn't be surprised if New York is not one of the leaders in this area—a Plastics Recycling Institute. The national institute in New Jersey, which is part of Rutgers University, is currently studying recycling of plastics. They're doing that and they're also conducting a massive study on the environmental effects of biodegradable plastics and what they may do to the underground water systems, the ecosystems, if, in fact, they are biodegraded.

All things, obviously, must go somewhere and unmodified plastics do not degrade. If they use unmodified, we can recycle them; if it's biodegradable, it's going to be ending up sometime in our environment and our shores and our waters.

So I wholeheartedly support the effort of Mr. Hochbrueckner, Mr. Henry, and Mr. McMillen on this effort, H.R. 5000. I suppose I have some reticence, and I want to be candid and frank about saying that, by a day certain, three years or five years—Mr. Hochbrueckner had 10, now he's got five—saying that all plastics have to be biodegradable because when they are, they're not recyclable and if they're biodegradable, the compounds go into our environment. I want to make sure that we're not removing a litter problem and creating a health hazard or an environmental problem with regard to our well water, with regard to the oceans, or with regard to our land.

So that area requires a great deal of research and it's so tempting, I think, Mr. Chairman, to say Nirvana is here. We can find a plastic that degrades, but when it degrades, the components obviously leach into the ground and into our well water and we may have other problems. We may be creating problems that we don't now anticipate.

I know that Mr. Hochbrueckner is sensitive to this, and I would hope that before the day comes that we mandate biodegradability of plastics, we recognize the potential health threats.

Mr. SCHEUER. Well, thank you very much for your words, Mr. Courter.

I don't think you have any fears that we're going to plunge into this thing without knowing what we're talking about. Mr. Hochbrueckner is an engineer and he's used to dealing with facts and knowing what they mean.

This is a subcommittee of the Science Committee and you can be assured that we will do whatever research is necessary to assure ourselves and the public that whatever the component parts of these biodegradable materials may be that when they biodegrade into the environment, they are not going to poison our groundwater; they are not going to provide an environmental hazard. We're trying to improve the environment, not further destruct it.

I think you can have confidence in this committee that we do our work with a degree of professionalism and that we will be sure to look at all of the implications that you have pointed out.

We appreciate your pointing them out to us.

Mr. COURTER. If I could just ask Mr. Hochbrueckner a question at this juncture, and I know that you've lots of important people who want to testify. I think your synopsis of the bill said that within five years, we're going to mandate the production of biodegradable plastics. If—and I have no doubt from what Congressman Scheuer says, that the people on this committee and the committee staff itself are very concerned about plastics—if we then found out that biodegradable plastics created another problem—all the while it eliminated the litter problem and the landfill problem—we would then have to obviously amend your legislation such that biodegradability was not made mandatory within a certain timeframe.

Mr. HOCHBRUECKNER. Well, let me respond by saying the way I have set the bill up, your—the point that you made is well taken and we were very sensitive about that because we recognize, for example, that at Rutgers, they've been doing a lot of experimenting with recycling plastics and, in fact, they do a very interesting and unique thing. They take plastics and they, in fact, make items such as fence posts, which is certainly a very smart thing to do with the plastic that, you know, is going to be around a long time, and so the goal in year 4, when the Commerce Department, in conjunction with EPA, comes up with, really, three lists—one list will say, "These items should be recyclable," and this will be defined in terms of the sensitivity to the environment because, obviously, we want to recycle as much of the plastics as possible.

If the EPA—the Commerce Department, along with EPA, decides that a particular type of plastic should be recyclable, they will put it on that list. If they feel that it does not produce an environmental hazard to, in fact, allow it to be degradable, then they can define a particular item to be on the degradable list, whether it is bio- or photo- really doesn't matter.

And, of course, if they determine that a particular item—say, plastic item—is neither—it's neither appropriate or convenient to recycle it—put it on the recyclable list or require it—require that it be degradable, they can then put it on an exempt list where they will say, "This particular item, you can't really do anything with it. It has elements in it that, in fact, would hurt the environment if they were photodegradable and we don't want to recycle them because they might cause a problem in that waste stream." Therefore, they would go on the exempt list where, in fact, they would ultimately go into a landfill, which is no different from today.

And so, the idea is to develop these three lists so that we define what goes where, taking into account the sensitivities of the environment, because you're absolutely right. We don't want a situation where you have an element of plastic that does, in fact, degrade, but then ultimately in some powder form, or in some other way, gets into our water or in some other way hurts us.

So that's the whole idea and that's why we've set it up this way. So you're absolutely right with your sensitivity and we've tried to accommodate it.

Mr. COURTER. Thank you very much, Mr. Chairman.

Mr. SCHEUER. This is the very beginning of the hearing process. The hearing process is designed to elicit testimony of exactly the kind that you're thinking about, Congressman Courter, as to what are the perhaps unintended consequences—that great law of unintended consequences that we're all familiar with, of doing something we think is constructive and finding out that it turns out to be part of the problem and not part of the solution.

The hearing process is designed to elicit all of that information, all of that data, and to encourage all of that research, which we will be doing. Okay?

Now, I hope the other members of Congress will be brief because we have to get on with the hearing. We've already been here over half an hour.

Congressman Lancaster of North Carolina.

## STATEMENT OF HON. MARTIN LANCASTER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NORTH CAROLINA

Mr. LANCASTER. Thank you, Mr. Chairman, and members of the subcommittee for allowing me to testify on the issue of plastic waste and the potential solution.

I have submitted to the committee a full statement. I will try to summarize that very quickly.

This issue has a special impact on my district and the State of North Carolina in a number of ways. North Carolina's 3rd District, like the districts many of you represent, lies on the coast. Plastic waste unquestionably presents a special hazard to marine life. Understandably, it's difficult to establish for certainty figures for marine fatalities due to ingestion of or entanglement with plastic debris each year. It's been estimated, however, that approximately 100,000 marine mammals and one million seabirds are killed by plastic debris each year.

In addition, there is a problem posed by our municipal landfills. The capacity of our existing sites is being filled at a rate barely dreamed of 20 years ago. In North Carolina, for example, we are approaching a real solid waste crisis. Almost a third of our municipal landfills will run out of permitted capacity in less than two years. Other States face even more immediate dilemmas.

It's worth noting that the fastest growing element of the burgeoning solid waste stream is plastic waste as the productions of plastics in the United States has increased from about six million pounds in 1960 to nearly 57 billion pounds in 1987.

Finally, there is a problem of unsightly and potentially hazardous plastic litter. It is important to understand that plastics are not only the culprit in the overcrowding of our landfills and the jeopardizing of our marine environment, however, it would be regrettable if we allowed ourselves to succumb to the paralysis to fail to act because we are caught in the endless debate over what the primary environmental culprit is.

That's why I'm especially grateful to Chairman Scheuer for convening these hearings and for placing his subcommittee's debate beyond a mere legislative hand-wringing session and towards realistic discussions of the solutions.

One of the truly promising solutions to the problems of plastic waste is an expanded use of plastics which quickly decompose. Sixteen States have now banned certain nondegradable plastic products and numerous others are considering such bans.

Degradable plastics can be manufactured with additives which make them either photodegradable or biodegradable. At least nine different processes for producing degradable plastics have been developed, most of which include adding degradable agents such as corn starch or synthetic substances directly into the standard plastic production process. Photodegradable plastics decompose when exposed to ultraviolet rays of the sun. Photodegradable plastic product has now been approved by FDA for use in indirect contact with food and an application for direct contact with food is pending.

Most biodegradables are made by adding substances such as corn starch to sheet plastic. I will introduce legislation this morning entitled Degradable Plastics Act of 1988. This bill deals only with degradability. I'm eager to have this concept incorporated into the proper recipe of workable solutions to the problem.

Degradability should not preclude recycling any more than it precludes public awareness campaigns to halt litter. The Degradable Plastics Act calls upon the EPA to establish rules requiring that a total of seven years after the enactment of this legislation certain plastic items are degradable. The defined plastic items include plastic storage cartons, bags and containers, packing materials, plastic rings on beverage six-packs, disposable diapers and plastic tampon applicators.

I'm glad the subcommittee has issued the broad-based challenge to confront our nation's solid waste problems. This debate has not been carried on by Congress with a national focus. Incremental steps, such as the implementation of the requirement that plastic six-pack ringholders be degradable and the discussion of requirements that Federal agencies focus their purchasing practices on degradable plastics, are positive steps in addressing some of the aspects of our solid waste problem.

What has been lacking, I believe, is a comprehensive Federal proposal that actually encompasses all the aspects included in State debates. I'm, therefore, pleased to have the opportunity to speak about my legislation on this issue, to be a cosponsor of the bill under discussion today, H.R. 5000, Congressman Hochbrueckner's Recyclable Materials Science and Technology Development Act.

The series of studies mandated by H.R. 5000 will provide a broader understanding of our waste stream and the impact of recycling and degradability in a number of areas, including national security and the Office of Recycling Research and Information.

I strongly endorse this bill and this concept that recycling and degradability should both be a part of the solution.

In summary, Mr. Chairman, degradability is one of the solutions which I believe must be pursued in response to our nation's problem with solid waste. It offers the promise of progress in all these areas. I realize that this is an issue which will not be resolved or even properly discussed within a few weeks or months, however I look forward to the debate on degradability and the other potential solutions in our solid waste problems.

I will be glad to answer any questions.

[The prepared statement of Mr. Lancaster follows:]

# Statement of Congressman H. Martin Lancaster

Before the Subcommittee on
Natural Resources, Agriculture Research, and Environment

Hearing on H.R. 5000
and the issues of degradability and recycling

August 10, 1988

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Mr. Chairman and members of the Subcommittee, thank you for allowing me to testify on the issue of plastic waste and the potential solution offered by degradability.

When the many labor-saving uses of plastics became apparent half a century ago, a new age of convenience began. There was an understandable tendency to believe that "disposable" somehow meant an item simply disappeared. Only recently has that misconception begun to fade, confronting us with the difficulties against which we must weigh the benefits of plastics and other waste products. Certainly today, life without plastics would be most difficult. For this reason, this is an area in which the federal government has a special obligation to take realistic steps to protect the environment.

This issue has a special impact on my District and the state of North Carolina in a number of ways. North Carolina's Third District, like the districts many of you represent, lies on the coast. Plastic waste unquestionably presents a special hazard to marine wildlife. This problem will not be completely solved by the adherence of the United States to Annex V of MARPOL, which prohibits the disposal of plastic from ships. In some coastal areas across the country, analysis of debris has revealed that more than a third of the plastic waste was not from vessels, but was strewn along the coast by beach-goers. A recent study by the Interagency Task Force on Persistent Marine Debris concluded that marine debris affects individuals of many endangered, threatened, and commercially valuable species of marine wildlife. Understandably, it is difficult to establish with certainty figures for marine fatalities due to ingestion of or entanglement in plastic debris each year. It has been estimated, however,

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that approximately 100,000 marine mammals and 1 million seabirds are killed by plastic debris each year.

In addition, there is the problem posed by our municipal landfills. Once we thought landfills would be the answer to our solid waste problems. This has not proved to be the case. The areas in which we can safely site landfills are dwindling, as a result of public opposition and new realizations about the potential hazards to our groundwater supply. At the same time, the capacity of our existing sites is being filled at a rate barely dreamed of twenty years ago. In North Carolina, for example, we are approaching a real solid waste crisis. Almost one-third of our municipal landfills will run out of permitted capacity in less than two years. Other states face even more immediate dilemmas. In New Jersey less than 15 landfills remain in operation. It is worth noting that the fastest-growing element of the burgeoning solid waste stream is plastic waste, as the production of plastics in the United States has increased from about 6 million pounds in 1960 to nearly 57 million pounds in 1987.

Finally, there is the problem of unsightly and potentially hazardous plastic litter. Millions of dollars are spent by coastal communities each year in beach clean-up efforts in order to avoid losing far greater amounts in tourism revenues.

In order to approach this problem constructively, however, it is important to understand that plastics are not the only culprit in the overcrowding of our landfills and the jeopardizing of our marine environment. Also, I do not view degradability as the exclusive solution to the plastic waste problem. However, it would be regrettable if we allowed ourselves to succumb to paralysis -- to fail to act because we were caught in endless debate over what was the primary environmental culprit. There is no single culprit. There is no single solution. That is why I am especially grateful to Chairman Scheuer for convening these hearings and for placing his Subcommittee's debate beyond a mere legislative hand-wringing session, and towards a realistic discussion of solutions. I believe we should be guided by an understanding that, in addressing this issue along a number of avenues at once -- recycling, landfill capacity, clean-up campaigns and increased public awareness, and degradability -- we can make meaningful headway in confronting some of our most pressing environmental problems.

One of the truly promising solutions to the problem of plastic waste is an expanded use of plastics which quickly decompose. This technology has been available for a number of years and environmentally benign plastics are already being marketed in Western Europe, Canada, and parts of the United States. Italy has banned non-degradable plastic packaging, effective in 1991. In the United States, 16 states have now banned certain non-degradable plastic products and numerous others are considering such bans.

Producing degradable plastics is a feasible long-term solution to the problems created by plastic waste. This is an area in which the federal government has a special obligation to take realistic steps to protect the environment.

Degradable plastics can be manufactured with additives which make them either photodegradable or biodegradable. At least nine different processes for producing degradable plastics have been developed, most of which include adding degradable agents, such

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as cornstarch or synthetic substances, directly into the standard plastic production process.

Photodegradable plastics decompose when exposed to the ultraviolet rays of the sun. Photodegradable plastics have been developed which may break down completely within two months on land or about three months at sea. Some of the processes which produce these plastics have, as their end product, water, carbon dioxide, nontoxic polymers, or small particles of metals such as nickel, cobalt, copper, and zinc, which are found naturally in the environment. A photodegradable plastic product has now been approved by the FDA for use in indirect contact with food, and an application for direct contact with food is pending. Canada's food and drug watchdog agency has already approved direct contact with food.

Most biodegradables are made by adding substances such as cornstarch to sheet plastic. The average kernel of corn is about 70% starch. Crops other than corn can be used to produce biodegradable plastics through fermentation into lactic acid. These include sugarcane, wheat, and barley. Products which have been made from biodegradable polymers include food packaging, shopping bags, garbage bags, polyethylene and polystyrene sheets, blow-molded bottles and vinyl wallpaper. Most biodegradable plastics break down into nontoxic, nonhazardous byproducts and many, such as a plastic bottle manufactured by Imperial Chemical Industries, will degrade in about one year when buried in a landfill.

I will introduce legislation this morning entitled the Degradable Plastics Act of 1988. Although this bill deals only with degradability, I am eager to have this concept incorporated into the proper recipe of workable solutions to the problem. Degradability should not preclude recycling any more than it precludes public awareness campaigns to halt litter.

The Degradable Plastics Act calls upon EPA to issue rules requiring that, a total of seven years after the enactment of this legislation, certain plastic items be degradable. The defined plastic items include plastic storage cartons, bags and containers; packing materials; plastic rings on beverage six packs; disposable diapers; and plastic tampon applicators. These items together constitute the vast majority of all plastic waste. Under the provisions of the Degradable Plastics Act, these products must be capable of decomposition at least two years after they are discarded.

There are potential limitations with both recycling and degradability. For example, it is much less cost effective to recycle plastics than to recycle other materials. Recycled aluminum can be sold by municipalities for 61 cents per pound. A typical green plastic bottle, on the other hand, brings less than one tenth of that, about 6 cents. There is the difficulty, especially in rural areas such as my District of North Carolina, in collecting sufficient quantities of homogeneous plastic to make recycling economical. There is also doubt as to whether some types of plastics, such as plastic bags because of the difficulty of collection, and diapers or chemical containers because of their potential toxicity, could ever be efficiently recycled.

Likewise, the drawbacks to degradability of some plastics are also apparent. There are a number of plastic articles that do have a useful life much longer than the few years implied by the degradability option. Although the rate of degradability can be carefully controlled and structural integrity can be maintained during proper storage, there are clearly some plastic items, such as the plastic telephones on our desks, which could not properly be made degradable. Also, no standards have yet been established for defining degradability. My bill would direct EPA to establish these standards, giving them a realistic time frame to serve as a guide.

I am glad the Subcommittee has issued this broad-based challenge to confront our nation's solid waste problems. As I stated earlier, the degradability option has been discussed in-depth in state Legislatures across the country. Most recently, the Governor of Florida signed a law banning nondegradable plastic six pack ring-holders, shopping bags, and polystyrene foam or plastic-coated paper used in connection with food. However, this debate has not yet been carried on by Congress with a national focus. Incremental steps such as the implementation of the MARPOL Treaty; the requirement that plastic six pack ring-holders be degradable; and the discussion of requirements that federal agencies focus their purchasing practices on degradable plastics are positive steps in addressing some of the aspects of our solid waste problems. What has been lacking, I believe, is a comprehensive federal proposal that actually encompasses all the aspects included in state debates -- actually asking for EPA to establish standards for the degradability of plastic items, within a specific time-frame; actually specifying articles which may reasonably be established as degradable.

I am therefore pleased to have had the opportunity to speak about my legislation on this issue, and to be a cosponsor of the bill under discussion today, H.R. 5000, Congressman Hochbrueckner's Recyclable Materials Science and Technology Development Act. The series of studies mandated by H.R. 5000 will provide a broader understanding of our waste stream and the impact of recycling and degradability in a number of areas including national security, and the Office of Recycling Research and Information will provide an important clearinghouse for data and research funding. H.R. 5000 gives the studies a clear focus -- regulations to prohibit the manufacture or sale of items listed by the Secretary of Commerce and the EPA Administrator. I strongly endorse this bill and this concept -- that recycling and degradability should both be a part of the solution.

In summary, Mr. Chairman, degradability is one of the solutions which I believe must be pursued in response to our nation's problems with solid waste, with litter, with hazards to wildlife. It offers the promise of progress in all these areas. I realize that is an issue which will not be resolved, or even properly discussed, within a few weeks or months. However, I look forward to the debate on degradability and the other potential solutions to our solid waste problems. I will be glad to answer any questions.

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Mr. **Hochbrueckner**. [presiding.] Congressman Lancaster, your testimony was so startling that the lights went out.

I'm delighted that you're a cosponsor of H.R. 5000 and I'd certainly be delighted to look at your legislation, too, because that issue you raised of degradability is absolutely an essential part of the overall solution to our waste treatment and garbage problem.

I'm delighted that you would testify, cosponsor, and we thank you for being here.

As you know, we probably have about six minutes left for this vote, so I thank you very much and this meeting will stand adjourned for about 12 minutes until we go vote and come right back.

Thank you, Martin.

[Recess.]

Mr. **Scheuer**. The subcommittee will reconvene.

We're happy to have Congressman Gilman here. Congressman Gilman is a leading member of the New York delegation, a senior member of the delegation and a highly respected and influential member.

Ben, we're very happy to have you here today. Please take such time as you may need.

## STATEMENT OF HON. BENJAMIN A. GILMAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. **Gilman**. Thank you, Mr. Chairman. I certainly welcome the opportunity to be able to voice my comments on H.R. 5000, the Recyclable Materials Science and Technology Development Act that has been introduced by our good colleague from New York, the distinguished subcommittee member, Mr. Hochbrueckner, and I want to commend our distinguished chairman, Mr. Scheuer, and the ranking minority member, Ms. Schneider, and all of the subcommittee members for the good work that they have been doing in demonstrating their commitment to the preservation of our environment and our natural resources in trying to find some solutions to the problems impacting upon our environment.

Mr. Chairman, as an original cosponsor of this legislation, along with Mr. Hochbrueckner, permit me to take just a few moments to describe some of the waste management obstacles confronting my region, which I think are typical of many of the regions in and around metropolitan areas of our nation.

In the 22nd Congressional District of New York, the landfill disposal crisis is one of our most serious problems. Over the past several years, we have witnessed a rapid proliferation of dumps and landfills of every possible variety. Often these sites are located perilously close to our local communities, and most alarmingly, to sole-source aquifers which supply the vital water supplies upon which we all rely.

Several months ago, I received a petition that was signed by some 200 school children from Tuxedo, New York, from an elementary school. Their petition stated that the children were having extreme difficulty concentrating on their classwork because they were nauseous and suffering from headaches due to the incredibly foul stench of a landfill located within a mile from the school.

That landfill, classified as a construction and demolition dump should, in theory, have contained nothing other than "clean" waste. Mr. Chairman, I visited that site, along with many other sites throughout our district, and I can assure you that those dumps can by no means be considered safe or unobtrusive.

The reduction of plastics and other nondegradable waste would do much to alleviate the crisis that we are facing with regard to our landfills. Many of the dumps and landfills in my district are approaching full capacity and virtually all of their operations are expected to cease by 1996. During this period, landfill capacity is expected to plummet from the current estimated level of some 1.4 million tons per year to an all-time low of 150,000 tons per year. In addition, enforcement actions by the New York State Department of Environmental Conservation have been closing unsafe landfills even before they are full to capacity.

I am convinced that the abundance of plastic and styrofoam packaging discarded at these sites severely contributes to the problem. We are informed that the volume of packaging waste has increased by 80 percent since 1960 and that plastics represent the fastest growing segment of this packaging boom. Unless we act now to reduce these materials, the problem is only going to be exacerbated and we'll truly come to know the full impact of the crisis of waste material.

H.R. 5000, I think, offers a viable alternative to help relieve the waste disposal nightmare. This measure seeks to open new markets for recycled products and encourages industry to develop innovative recycling technologies for non-durable product packaging. After a five-year period of Federal leadership into enhanced recycling research, the bill requires that most product packages either be recyclable or biodegradable. Manufacturers will be responsible for developing new technologies, affording them the opportunity to derive techniques uniquely suited to their own manufacturing processes and marketing strategies.

I believe that H.R. 5000 provides a reasonable approach to the waste management crisis without being overly burdensome or detrimental to competitive industry. As we move to prohibit the ocean dumping of treated sewage sludge, and enact legislation such as that co-sponsored by the subcommittee's ranking minority member, Ms. Schneider, it's more important than ever to develop alternative waste management techniques.

Accordingly, Mr. Chairman, and members of the subcommittee, I urge you to grant favorable consideration to this measure, and I welcome the opportunity to work with the committee toward the enactment of positive legislation so that we can alleviate the crisis that is confronting so many of our metropolitan areas.

Thank you, Mr. Chairman.

Mr. SCHEUER. Thank you very much, Congressman Gilman. We very much appreciate your testimony.

I'm now going to yield the Chair to my colleague from New York, Congressman George Hochbrueckner, to chair the next panel.

Congressman.

Mr. HOCHBRUECKNER. [presiding.] Thank you, Mr. Chairman.

Thank you, Mr. Gilman. I appreciate your cosponsorship and your kind words.

At this point, I'd like to invite up the second panel: Ms. Jeanne Wirka, of the Environmental Action; Mr. Patrick Toner, Society of the Plastics Industry; and Mr. George Kirkpatrick, Florida State Senator.

Mr. SCHEUER. Mr. Kirkpatrick, would you come up here just a moment. I'd like you to present Mr. Hochbrueckner with this very distinguished award, with a few pertinent remarks.

Mr. KIRKPATRICK. In Florida, we created—

Mr. SCHEUER. Why don't you sit right down. Sit down, George, and speak into the mike.

Mr. KIRKPATRICK. In Florida, we created what we call the Order of the Golden Garbage Can and anybody who was making an active effort to try to do something to help us eliminate the solid waste disposal in Florida or throughout the country—

Mr. SCHEUER. Hold it up for the cameras.

Mr. KIRKPATRICK. —we created this little golden garbage can and we have a lot of folks around the country who are wearing these very proudly, and since you've done such a good job introducing this legislation, we'd like to put one of these on next to this very prestigious thing that you have in your coat and make you an official member of the Order of the Golden Garbage Can and say how much we appreciate everything you've done to help us get the program started.

Mr. SCHEUER. Thank you very much, Senator.

[Applause.]

Mr. HOCHBRUECKNER. Thank you, Senator. I am greatly moved and I will wear this with great pride.

May we begin. I notice we have another vote that has just been called.

Mr. Chairman, I guess we have a choice. We have another vote that was just called. We could begin with the first speaker or we could—I could run over, come back quickly and begin.

Mr. SCHEUER. We're on the five-minute rule. Why don't we hear the first speaker and then we'll adjourn. Okay?

Mr. HOCHBRUECKNER. Yes, sir.

I'd like to ask Ms. Jeanne Wirka, of Environmental Action, to present to us.

## STATEMENTS OF JEANNE WIRKA, ENVIRONMENTAL ACTION; HUGH PATRICK TONER, SOCIETY OF THE PLASTICS INDUSTRY; AND GEORGE KIRKPATRICK, FLORIDA STATE SENATOR

Ms. WIRKA. Thank you.

Mr. Chairman, and members of the committee, my name is Jeanne Wirka. I am a research analyst with the Solid Waste Alternatives Project of Environmental Action Foundation.

Environmental Action Foundation is a national and nonprofit environmental research and education organization based here in Washington, D.C.

I would like to just summarize my statement and submit the full written statement for the record.

On behalf of Environmental Action Foundation, I'd like to thank the committee for this opportunity to testify. I particularly want to thank and commend the committee for addressing the recyclability and degradability of consumer product packaging as potential solutions to the solid waste crisis facing this country.

Many features of H.R. 5000 place the Federal Government in a role of very positive leadership in this area that is sorely needed.

I'm going to quickly summarize the first part of my statement about some of the environmental impacts of plastics packaging that haven't been raised so far. I'm going to briefly skip over the litter and solid waste problems because other people have addressed those so far, but there are a couple of other things I want to mention.

First of all, the environmental consequences of the 50 billion pounds of plastic that are being produced right now include, in addition to litter and solid waste—include resource depletion. The use of throw-away plastic packaging results in a very high and unnecessary level of resource depletion. Both the raw materials and the energy source for plastics production are scarce and nonrenewable petroleum and natural gas.

Questions about the future availability of petroleum and natural gas must inform this debate about plastics waste management policies. Despite massive explorations since 1970, no worldwide reserves of economically accessible petroleum and natural gas have remained level and can be expected to last only 32 to 60 years at present consumption rates. As domestic supplies dwindle, we will be expected to increase our imports of petroleum and natural gas, and given the current situation in the Middle East, we need to be asking ourselves whether our dependence on throw-away plastic products is worth the price that we may be paying.

Second of all, the production of plastics packaging releases significant levels of toxic pollutions into the atmosphere and adds to the growing hazardous waste burden, as Mr. Henry mentioned at the beginning of these hearings.

The Congressional Budget Office estimates that we, as a nation, are producing 266 million tons of hazardous waste each year. That's more than a ton per person each year. It's more hazardous waste per person than solid waste per person.

It's difficult to ascertain exactly what the total volume of waste produced by the plastics industry is, but the study by CBO has found that over—the segment of the chemical industry that produces the resins commonly used for packaging plastics generated over 5 million metric tons of hazardous waste in '84. The processing industry, over 8 million metric tons.

These figures don't even begin to reflect the waste generated by the production of the many organic and inorganic chemical raw materials used by the industry. The organic chemicals segment of the chemical industry itself was responsible for 47 million tons of hazardous waste.

So broken down by the types of chemicals that are produced, the production of which produces large volumes of hazardous waste—an EPA ranking of the 20 chemicals whose production generates the most total hazardous waste, five of the top six are chemicals commonly used by the plastics industry.

These include propylene, which is ranked first, phenol, third, ethylene, fourth, polystyrene, fifth, and benzene, sixty. In 1980, 44 percent of the propylene, 73 percent of phenol, 61 percent of ethylene and 72 percent of styrene were consumed by the plastics industry.

And I'm only going into this in detail because, when we look at degradable plastics, the question is whether, you know—you have to look at the whole broad spectrum of environmental problems associated with plastics, not just with litter and solid waste. That's something I just wanted to keep in people's mind.

Again, I'm not going to go into plastics in solid waste and litter because those facts and figures have already been mentioned several times, but I wanted to address myself to the role of degradable plastics in mitigating the problems that have come before us today: marine plastic pollution, wildlife entanglement, litter and solid waste.

Again, I'm not going to go into can plastics be made degradable because obviously they can and there are people here who plan to talk more to that, but I would rather focus on whether they should be. Despite product availability and legislative initiative, unanswered questions about plastics that disappear keep reappearing.

The debate about whether plastics should be made degradable has several facets. Will degradable plastics perform the waste and litter reduction functions they're designed for; are there better ways of achieving these ends and will degradability preclude more promising waste reduction strategies such as recycling and source reduction?

Another way of framing the question of whether degradables will result in litter or solid waste reduction is to ask can the rates of degradation be controlled and ensure a variety of conditions so that environmental benefits may be gained without compromising package reliability and safety?

I'm not going to go into those questions of package reliability and safety because there are others here who will probably address them better than I am.

I wanted to rather skip down to a problem that is of great concern to Environmental Action and has actually been mentioned already, and that is what, if anything, is left over when these products degrade?

To date, there's been—that we know of, no independent testing of the end products of either biodegradable or photodegradable plastics. As was mentioned earlier, some of the chemical additives used to make standard everyday plastic products contain toxic chemicals, including heavy metals. In nondegradables, additives and chemicals used in plastics remain inert. They remain bound in the structure of the plastic.

Little is known about what types of additives are used in degradable resins or what would happen if the additives used in regular plastics—what would happen to them if these plastics were designed to fall apart.

Nor have the rates—in addition to these questions, the rates of degradation of degradable plastics haven't been—that I know of—compared with rates of degradation for naturally degradable materials, such as paper and other paperboard packaging materials.

This is something that we would recommend that, in your appropriating money for studies about the availability and applications for degradable plastics, that specifically four questions be addressed.

One, what is the nature of the end product's degradation? Two, will the additives used in degradable plastics pose a threat to recycling efforts? By that, I mean, when you mix in a degradable bottle with a mixed plastic recycling system, such as they are doing research on at Rutgers, how much of those degradable bottles can you have in there before the plastic lumber that comes out at the end becomes unstable?

Third, can the rates of degradation be adequately controlled? One of the things, especially in the area of marine plastic pollution, is that you have a photodegradable resin in the ocean, before long, that piece of plastic is going to become covered with algae. It's going to be colonized by algae, basically cutting off the sunlight. Is there a way to control the rate of degradation so we can be sure that photodegradable resins in the ocean degrade before this happens? That's a key area.

Finally, bearing in mind that plastics modified to be degradable are not the only type of degradable packaging, we would like to see these products again compared with other naturally degradable packaging alternatives in an overall Environmental Impact Statement that looks both at the hazardous waste produced at the beginning of the production process and whether or not they're going to degrade or disappear in the end.

I just wanted to make one last point, that ultimately—even if degradable plastics prove to be safe and effective, which they may well prove to be, we have to keep in mind that as a solution to one environmental problem, they may—will continue to cause others and do nothing to change our wasteful patterns of resource depletion. Like regular plastics, degradable plastics will use up dwindling reserves of petroleum and natural gas and like regular plastics, the production of degradables will continue to load the environment with significant amounts of hazardous pollution. That, I think, should be kept in mind.

Mr. **Hochbrueckner**. At this point, let me just interrupt you. I must run off and vote. Fortunately, the chairman should be back in just a few moments to continue and at that point, you can have a—

Ms. **Wirka**. Okay, do you want me to stop now?

Mr. **Hochbrueckner**. I'll just say we'll have Mr. Kirkpatrick and Mr. Toner—

Ms. **Wirka**. Okay, fine.

[The prepared statement of Ms. Wirka follows:]

**Environmental Action Foundation**

1525 New Hampshire Avenue, N.W. Washington, DC 20036 (202) 745-4871

TESTIMONY OF JEANNE WIRKA
SOLID WASTE RESEARCH ANALYST
ENVIRONMENTAL ACTION FOUNDATION

BEFORE THE SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH, AND ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ON H.R. 5000
THE RECYCLABLE MATERIALS SCIENCE
AND TECHNOLOGY DEVELOPMENT ACT OF 1988

AUGUST 10, 1988

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Mr. Chairman and members of the Committee, my name is Jeanne Wirka, research analyst with the Solid Waste Alternatives Project of Environmental Action Foundation. Environmental Action Foundation is a national, non-profit, environmental research and education organization based in Washington D.C.

On behalf of Environmental Action Foundation, I want to thank the Committee for this opportunity to testify today. I particularly want to thank and commend the Committee for addressing the recyclability and degradability of consumer product packaging as potential solutions to the solid waste crisis facing this country.

No longer an "out of sight, out of mind" issue, nor strictly a state and local problem, garbage is going to be of increasing concern to Congress in coming years. H.R. 5000 places the federal government in a role positive leadership in the development of alternative solid waste management strategies.

In this first day of hearings on H.R. 5000, you are focusing on the present and potential applications of photodegradable and biodegradable plastics in solving environmental problems, including marine pollution, the impact of plastics on marine animals, municipal waste disposal, and litter. As Environmental Action Foundation's primary researcher on the environmental effects of plastics packaging and author of a recent report entitled Wrapped in Plastics: The Environmental Case for Reducing Plastics Packaging, I want to address the role of degradable plastics for mitigating the problems mentioned above in relation to plastics recycling--another plastics waste reduction strategy--and the

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environmental impact of plastics packaging in general.

## Plastics-Related Environmental Problems

Plastics are now used in nearly every facet of modern life--from artificial hearts to soda straws. The plastics industry continues to grow at a phenomenal rate, with production jumping from 19 billion pounds in 1972 to 48 billion pounds in 1985. The plastics industry projects production to grow to 76 billion pounds by the year 2000--a 36 percent increase. Over 12 billion pounds is now used for packaging alone. In another decade, the volume of plastics packaging will almost double, consuming 23 billion pounds of plastics resins by the turn of the century.

Meanwhile, the United States Environmental Protection Agency estimates that half of the country's municipalities will run out of landfill space in 10 years--a third in only five years.

In the midst of this solid waste crisis, packaging has been singled out because it now comprises one-third the weight and roughly half the volume of the municipal solid waste (MSW) stream. Furthermore, it is often unnecessary, used more to catch the eye of the consumer than to protect the product. Remarkably, more than half of the paper and glass and roughly one-third of plastics produced in the United States are used in items with a lifespan of less than one year.

Plastics now make up the third largest--and fastest growing--segment of the packaging industry, exceeded only by paperboard and metals. Like other types of packaging, plastics packages are largely designed for single use--it is made to be thrown away. On average, each American uses and discards 60 pounds of plastics packaging a year.

The environmental consequences of these vast volumes of single-use discarded plastics packaging are numerous:

- The use of throwaway plastics packaging results in an unnecessary level of resource depletion. Both the the raw materials of and the energy source for plastics production are scarce and non-renewable resources, namely petroleum and natural gas.
- The production of plastics packaging releases signficant levels of toxic pollutants into the atmosphere and adds to the nation's growing hazardous waste burden.
- Plastics are virtually non-degradable, remaining in the environment for hundreds of years, whether on the land and in the ocean as "litter" or in landfills as "solid waste."

**Resource Depletion**

Questions about the future availability of petroleum and natural gas must inform the debate about plastics waste management policies. Despite massive exploration since 1970, known world-wide reserves of economically accessible petroleum and natural gas have remained level and can be expected to last only 32 to 60 years at present consumption rates. As domestic supplies dwindle. petroleum imports are expected to rise dramatically. With the current volative military and political situation in the Middle East. it may be said that reducing our dependence on petroleum for throwaway plastics products--and other unnecessary uses--is in the interest of both economic stability and national security.

**Toxic Pollution**

The Congressional Budget Office (CBO) estimates that in 1983, 266 million tons of hazardous waste were generated--more than a ton for every person in the United States. The complicated structure of the plastics industry makes exact calculations of the total amounts of hazardous waste generated difficult to come by. The industry as a whole includes the producers of the industrial organic chemicals that are used as monomers (SIC 286), the polymer and resin manufacturers, (SIC 282), producers of the various chemical additives (included in SIC 28). and plastics processors (mostly SIC 3079).

But some indication of the volume and types of waste created by various components of the plastics industry can be derived from data generated by CBO. The segment of the chemical industry that produces the resins commonly used for packaging plastics (SIC 2821) generated over 5 million metric tons of hazardous waste in 1984. The plastics processing industry (SIC 3079) was responsible for 8.7 million metric tons.

These figures, however, do not reflect the waste generated by the production of the many organic and inorganic chemical raw materials used by the industry. The organic chemicals segment (SIC 286), which supplies many of the raw materials for polymer and resin production. was itself responsible for 47 million tons, or 18 percent of the total. When broken down by the types of chemicals produced, the role of plastics production is more apparent.

In an EPA ranking of the 20 chemicals whose production generates the most total hazardous waste. five of the top six are chemicals commonly used by the plastics industry. These include propylene (ranked first). phenol (third). ethylene (fourth). polystyrene (fifth) and benzene (sixth). In 1980, 44 percent of propylene, 73 percent of phenol. 61 percent of ethylene, and 72 percent of styrene produced were consumed by the plastics industry.

**Litter**

There is evidence that plastics litter is on the rise both on the

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land and at sea. A litter survey performed by the Michigan Department of Transportation (DOT) in 1986 found that plastics containers have increased 32 percent over the amount counted in 1980. According to the DOT, plastics comprised 38 percent of all fast-food containers and styrofoam containers are the most numerous item littered along the highways.

The amount of plastics in the ocean is not known, but according to the Center for Environmental Education, about 14 billion pounds of trash are thrown into the sea every year. Recent headlines of plastics debris and medical wastes washing up on our eastern shores have simply highlighted a longstanding problem.

The world's merchant fleet alone discards an estimated 639,000 plastic containers every day. During a three-hour beach clean-up in 1987 along 157 miles of Texas beaches, volunteers collected: 31,773 plastic bags. 30.295 plastic bottles 15,631 plastic six-pack rings, 28,540 plastic lids, 1,914 disposable diapers, 1,040 tampon applicators and 7,460 milk jugs.

Although some ocean litter originates on land, it is generally believed that most of it comes from ocean sources. In addition to "domestic" garbage from ships, plastics find their way into the ocean in the form of abandoned fishing nets and other gear, and cargo-related packaging materials. Types of plastic ocean debris that originate on land include: raw plastics pellets discharged into waterways by plastics manufacturers; tampon applicators, condoms, and diapers discharged in sewage sludge; chunks of styrofoam flotation devices from the degradation of docks and marinas; and littering by the public.

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## PLASTICS IN BEACH DEBRIS

| State | "Styrofoam" | Bags/Sheets | Fishing Gear | Bottles/ Containers | Sixpack Carriers |
|---|---|---|---|---|---|
| Alaska (1982) | 8.8* | | 67.1 | | |
| Maine (1986) | 27.4 | 10.4 | 11.4 | 13.0 | |
| Mass. (1986) | 5.7 | 36.5 | | 13.2 | |
| New Jersey (1986) | | 6.2 | | 38.6 | 5.2 |
| Texas (1986) | 8.3 | 13.9 | | 15.2 | 9.2 |
| Oregon (1986) | 59.2 | | 9.2 | | 3.5 |
| California | 5.6 | | | | 3.3 |

* Percentages by weight

It is estimated that up to one million seabirds and approximately 100,000 marine mammals die each year after ingesting or becoming entangled in plastics debris. Birds easily mistake floating pieces of plastics for food; sea turtles have been strangled by plastic bags they mistake for jellyfish, a main source of food; and seals are frequently found entangled in discarded plastic fishing nets and other debris. According to David Laist of the Marine Mammal Commission in Washington D.C., "Plastics may be as great a source of mortality among marine mammals as oil spills, heavy metals, or other toxic materials."

### Solid Waste

Americans generated nearly 150 million tons of solid waste in 1984, a full 25 percent more than in 1970. How much of this mountain of waste is plastics? According to one expert, the amount of plastic thrown away in 1984 would fill 15 to 20 thousand "garbage barges" the size of the infamous Mobro 2000 that wandered the seas and made headlines in 1987.

A recent study conducted for EPA by Franklin Associates Ltd. concludes that plastics accounted for 9.6 million tons, or 7.2 percent by weight of the municipal solid waste stream in 1984. This is expected to increase to 15.5 million tons, or 9.8 percent by weight in the year 2000. By volume, plastics account for over 30 percent and are projected to reach 40 percent of the waste stream by 2000. Plastics accounted for 11.5 percent by weight of all packaging thrown away. This means that roughly 5 million tons, or over half of all plastics in the waste stream, are packaging.

As the related problems of plastic litter, ocean pollution, and solid waste have received increasing public and legislative attention in recent years, many people have looked to the promise of degradable plastics and plastics recycling to mitigate these problems. I want to address each of these in turn, specially regarding the relationship between the two; their relative promise for solving plastics-related environmental problems; and areas of needed research and development.

## Degradable Plastics

There are two ways that plastics can be made to deteriorate: photodegradation and biodegradation. Photodegradation occurs as a result of exposure to ultraviolet light. Biodegradation works through the action of microorganisms (bacteria and fungi) that secrete enzymes capable of breaking down polymers into components small enough to be digested. While there have been some inroads into making biodegradable

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plastics, scientists seem to have had more success with photodegradables.

Photodegradables are designed for applications where the persistence of plastics in an outdoor environment is problematic. They have therefore been generally looked to as a potential solution to the plastics litter problem, rather than the solid waste problem. But some photodegradables, which degrade through a process known as "photo-initiated oxidation" are designed to begin degrading in sunlight and then continue degrading when buried.

Five photodegradable technologies were presented at a Symposium on Degradable Plastics sponsored by the Society of the Plastics Industry in June of 1987. Commercially available photodegradable resins are produced by three industry giants, including Union Carbide, Dow Chemical, and DuPont; and by three smaller companies, including Ecoplastics Ltd. (Willowdale, Ontario). Ampacet Corp. (Mt. Vernon. New York), and Ideamasters Inc. (Miami, FL). Princeton Polymer Labs offers a patented photodegradable technology for license to manufacturers, but does not produce its own resin.

In order to biodegrade, polymers must break down into molecules small enough to be digested by microorganisms. Because of their high molecular weight, packaging plastics have resisted attempts to make them biodegradable. But three technologies that have made inroads into biodegradability were reported at the SPI Symposium. ICI Americas has developed a polyester copolymer that is itself susceptible to the enzyme action of microorganisms. The remaining two technologies, developed by St. Lawrence Starch of Ontario. and the U.S. Department of Agriculture, respectively, utilize starch as a biodegradable additive.

Because they are designed to degrade in an active microbial

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environment--such as a landfill, sewage system, or the ocean, biodegradables have been looked to as a potential solution to the related problems of solid waste and ocean pollution, rather than roadside litter.

**Should plastics be made degradable?**

Despite product availability and legislative initiative, unanswered questions about plastics that "disappear" keep reappearing. The debate about whether plastics should be made degradable has several distinct facets: 1) Will degradable plastics "perform" the waste and litter reduction functions they are designed for?; 2) Are there better ways of achieving these ends?; and 3) Will degradability preclude more promising waste reduction strategies such as recycling.

Another way of framing the question of whether degradables will result in litter or solid waste reduction is to ask: Can the rates of degradation be controlled and assured in a variety of conditions so that environmental benefits may be gained without compromising package reliability and safety?

Opponents of mandatory degradability argue that the chemical modifications necessary to impart degradability would have a negative effect on the very properties of plastics that make them desirable packaging materials. Packagers worry that degradable packaging might break down prematurely, thereby shortening shelf life and possibly requiring special handling and storage procedures. Manufacturers of photodegradable plastics dismiss these concerns as unfounded, insisting that the physical properties of their respective products are similar to nondegradable plastics.

Biodegradables have been criticized further for potentially attracting microbial contamination and therefore being unsuitable for food packaging. This claim is refuted by both ICI and St. Lawrence Starch, two manufacturers of biodegradables. According to these manufacturers. their products require a very active microbial environment in order to biodegrade, such as the type of environment present in a landfill, a sewage system, or the ocean.

No degradables are currently sanctioned by the Food and Drug Administration for food contact applications But each of the companies listed above are conducting the requisite tests and most are optimistic that sanction is immanent. EcoPlastics' Ecolyte currently has a status of "no objection" from the Ontario Department of Health and Welfare (the Canadian equivalent of FDA).

Even if questions of package reliability were answered, there is the question of whether the rates of degradability would be fast enough to offer any short-term aesthetic or long-term waste reduction benefits.

For some degradables, rates of degradation can be controlled by varying the level of additives or molecular groups that catalyze the degradation process. The photodegradable resin used for six-pack holders, for example, can be made to degrade more quickly or more slowly by altering the concentration of carbon monoxide molecules. According to Union Carbide, photodegradable resin it has developed for six-pack carriers in mandatory-degradability states, "have met the state requirements for degradation, with few problems--in all seasons across the country."

Critics of biodegradable plastics argue that the rate of degradation is too slow to extend the life of a rapidly filling landfill. But studies conducted by the Center for Environmental

Management at Tufts University have found that the life of a landfill can be extended by increasing the rate at which waste decomposes. According to ICI, a PHBV biodegradable bottle in a landfill will disintegrate significantly in a year. According to St. Lawrence, an Ecostar bag made with 6 percent starch would degrade completely in three to six years.

Others point out that biodegradability would be especially useful for those plastics products that prevent other components of the waste stream from degrading, especially plastic baby diapers and trash bags. Degradable bags for yard wastes, for example, would aid in large composting operations. St. Lawrence is currently working on an Ecostar composting bag that would degrade in less than four months.

Unfortunately, with respect to product performance and rates of degradability, we have little information to go on except the technical documentation provided by the companies who produce these products. Without reliable, objective, and comprehensive product testing, it is difficult to weight the the costs and benefits of degradability against other litter and solid waste reduction strategies.

In the case of ocean pollution, evidence presented at the SPI Symposium on Degradable Plastics suggests that both photodegradable and biodegradable plastics may help mitigate the problem. However, their effectiveness in doing so has also not been established. Unanswered questions in this area include:

1) How well will the degradation processes work in an ocean environment?

2) What would be the criteria for determining which commodity plastics should be required to be degradable, specifically in relation to their role in ocean pollution? and

3) What is the time scale for degradation. In the case of photodegradables. is the rate of degradation fast enough to substantially degrade the material before sunlight is blocked off (if the material is colonized by algae, for example).

Research has shown that the photodegradable polyethylene used for six-pack loop carriers will degrade both on land and at sea, but that the rates of degradation at sea is apparently slower than that on land. Likely factors in the slower degradation rate may include lower temperatures at sea and macrofouling by algae.

With respect of ocean pollution. however, the question of which plastics should be made degradable may be difficult to determine. Should all plastics products used on ships be required to be degradable? Should all plastics fising gear be degradable? Should plastics products found in sewage sludge (diapers. tampon applicators, condoms) be required to be degradable?

In certain cases, such as fishing gear which is routinely abandoned at sea and results in ongoing wildlife entanglement and incidental take, the benefits of degradability seem clear enough to mandate research in that area. But for other products that contribute to ocean pollution, the water begins to get murky. The costs and benefits of degradability need to be weighed against alternative solutions. How difficult would it be to prevent ships from routinely dumping their trash overboard? What are the inefficiencies inherent in sewage treatment systems that allow plastics products (and therefore, most likely, raw sewage) to escape into the sea? Why are we dumping municipal waste in the ocean to begin with?

But the most serious environmental question raised about degradable plastics is what if anything. is left over after degradable plastics disintegrate. Some of the chemical additives used to make regular

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plastics contain toxic heavy metals. In non-degradables, these additives remain bound into the structure of the plastic. But little is known about the types of additives used in degradable resins, or what would happen to the additives used in regular plastics if these plastics were modified to become degradable.

Some manufacturers of degradables addressed concerns about toxicity at the SPI Symposium last summer Admitting that little is known about the effects of additives used in plastics, Ideamasters reported that it had conducted tests on the residual decomposition products of Plastigone, which include organic chemicals and heavy metals such as iron and nickel While further testing is planned. Ideasmasters reports that the initial results indicate that "even with prolonged usage, the effect of degradation products of Plastigone in the soil are negligible."

ICI reported that his company's natural PHBV biodegrades into carbon dioxide and water. According to one company representative, "none of the products of this degradation process offer any toxic or ecological hazard. PHBV, therefore. recycles completely and safely back into nature." Similarly, Dr. James Guillet, inventor of Ecolyte, told the SPI Symposium that his process "does not introduce any toxic or potentially toxic materials."

But to date, no independent testing of the end-products of degradation has been done. Nor have the rates of degradation of degradable plastics been compared to those of paper and other packaging materials. It would not be good environmental policy to make a national commitment to degradable plastics without first knowing their environmental impact. There is a critical need for the federal government to take the lead in this area, since state and local legislators around the country are increasingly interested in degradable plastics.

Ultimately, even if degradable plastics prove to be safe and effective. we must keep in mind that as a solution to one environmental problem, degradable plastics will continue to cause others and do nothing to change our wasteful patterns of resource depletion. Like regular plastics, degradable plastics will use up dwindling reserves of petroleum and natural gas. And like regular plastics, the production of degradables will continue to load the environment with a signficant load of hazardous pollutants.

Finally, there is a fear among recyclers that widespread use of degradables may do damage to the plastics recycling industry. Among the unanswered questions about degradables is whether the additives used to achieve degradability will contaminate batches of mixed or single resin secondary plastics.

**What can the federal government do?**

Because of the unanswered questions raised above, Environmental Action Foundation is not ready at this time to recommend degradable plastics as a major solution to plastics-related environmental problems. We would like to see independent scientific research conducted to address the following issues:

o What is the nature of the end-products of degradation?

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- Will the additives used in degradable plastics pose a threat to recycling efforts?

- Can the rates of degradation be adequately controlled?

- Bearing in mind that plastics modified to be degradable are not the only type of degradable packaging, we would like to see these products compared with paper or paperboard alternatives through an overall environmental impact-type assessment. Where naturally degradable alternatives exist (such as for tampon applicators and shopping bags), it would seem wise to promote those alternatives over degradable plastics.

Based on the above analysis of degradable plastics, it is the assessment of Environmental Action Foundation that recycling is a much more promising solution to the plastics-related environmental problems outlined above. But as with degradable plastics, there is a large amount of research and development needed to make plastics recycling an effective and economic waste reduction strategy.

### Plastics Recycling

Plastics recycling is now receiving more attention from waste management officials, recyclers, environmentalists, and the plastics industry than ever before. But to date, the volume of plastics recycled has been miniscule compared to the amount discarded. The only large-scale recycling of a post-consumer package has been in states with mandatory beverage container deposits. But the 20 percent recycling rate for PET achieved in 1987 resulted in the diversion of only 150 million pounds. Overall, only 1 percent of the 9.7 million tons of plastics discarded in 1984 was recovered for recycling.

One reason for the low rates is that plastics recycling is the "youngest" of the recycling industries. Recycling experts predict that skyrocketing disposal costs, pressure from state governments, and the

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steadily increasing cost of virgin resins will push plastics recycling to catch up with the recycling of other materials. But this will not happen without concentrated efforts by government, business and civic leaders, the general public, and the plastics industry itself.

A successful national plastics recycling effort will require the simultaneous development of collection systems, technologies, and markets. Some of the necessary research and development is now being carried out at research centers such as the Center for Plastics Recycling Research (CPRR) at Rutgers University in New Jersey and at the Plastics Recycling Applied Research Institute (PRARI) in Lowell, Massachusetts.

### Collection

The best way to collect plastics for recycling is to divert them from the waste stream altogether Once plastics are mixed in with banana peels, coffee grounds, and other components of household trash, it becomes prohibitively expensive to separate and clean them. Diversion can be achieved either through a deposit system such as the bottle bill, through curbside collection programs, or buy-back and drop-off centers.

But a major problem facing recycling officials is that the scrap value of most recycled resins is low compared to the cost of collecting and reprocessing them. Because plastics take up a disproportionate amount of space in collection boxes and trucks, they are more expensive to collect than other materials at the same time that they bring in less revenue because of their low scrap value.

But, in spite of the difficulties, curbside collection of plastics is increasing. In a joint plastics recycling feasibility study, solid waste officials in Massachusetts and Rhode Island looked at the actual experience of 41 multi-material collection programs in the United States, Canada, and Europe that include plastics. A final Plastics Recycling Action Plan profiles eight of these programs.

According to the Massachusetts-Rhode Island study, the operators of the eight profiled programs reported plastics recovery levels of 2/3 to 9 pounds per capita annually for programs targeting PET and/or HDPE. They further reported that in multi-material programs. the higher collection costs for plastics could be offset by the revenues from other materials.

Another way to pay for the collection of plastics is through deposits. which essentially subsidize the costs of collection. In fact, there would be very little plastics recycling today if it weren't for the nine states that have enacted bottle bills. Deposit systems have the clear advantage of segregating plastic bottles of a known resin type from other plastics. Since most plastics recycling systems today are designed to take single-resin containers, when mixed plastics are collected at curbside, recyclers face the costly and time-consuming task of hand-sorting. Certainly, a national bottle bill would vastly increase the plastics available for recycling.

### Technology Development

Plastics recyclers refer to two general types of recycling processes. **Primary** recycling involves turning waste materials into new products that have characteristics essentially the same or similar to the original product. **Secondary** recycling creates new products that make fewer chemical or physical demands on the material.

Primary recycling has been carried out for years by the plastics manufacturing sector which routinely reuses clean industrial scrap. But "post-consumer" plastics recycling is another story. The billions of bottles and rigid containers and reams of flexible packaging that are tossed away everyday cannot be recycled as easily as clean industrial scrap. Those that are collected for recycling must undergo a secondary recycling process. In other words. recycled PET soda bottles may end up as fiberfill stuffing or as a plastic park bench, but they will never reappear on the shelf as PET soda bottles.

Why not simply make new bottles from old bottles?

First, plastics degrade with repeated heating. Prime virgin resin is made with stringent technical specifications to meet the requirements of the intended end product. When plastic scrap is reheated in the recycling process, its properties (strength, flexibility, clarity, etc.) are degraded. making the recycled material less desirable for certain applications.

End-use applications for recycled plastics are further limited by Food and Drug Administration (FDA) rules. If recycled materials are to be used to package food, manufacturers must guarantee that they are free of contaminants. Since plastics cannot be reheated to high-enough temperatures to insure this, plastics are currently not reused for food packaging.

In addition, each type of plastic has different physical and chemical characteristics. Each has a different melting point and reacts differently to reheating. Because of this, most plastics recycling systems are designed for single-resin containers that are easily identifiable and therefore relatively easy to separate from other plastics. Segregated single-resin plastics also bring the best prices on the secondary materials market. But the plastics recycling industry is on the verge of a revolution. Technologies that recycle mixed or "co-mingled" plastics have been used in Europe for years and are now being imported to the United States.

A national commitment to plastics recycling would require a broad-based system that includes several technological approaches. Two technologies, those that create regrind from PET and high-density polyethylene (HDPE) bottles are already in use and have the potential for vastly increased growth. Polyolefin separation systems developed in Canada and Europe are able to separate lighter polypropylene and polyethylene from heavier plastics. Finally, mixed plastics technologies, also of European descent, can take a mixed plastics waste stream and turn it into a variety of end-use products. Currently, the CPRR and PRARI are conducting research in this area.

## Markets

The development of collection systems and recycling technologies can proceed only to the extent that markets are developed for the products made out of recycled plastics. As with other recycled materials, material supply and market capacity must be increased simultaneously. Only market and capacity development will convince local governments to add plastics to their recycling systems.

The market for regrind PET is relatively strong due to the sustained flow of material coming from bottle bill states. Thanks to a world-wide ethylene shortage, markets for recycled polyethylenes have been rapidly expanding. And export markets for polyolefin pellets for molded products are expanding. Each of these markets will require development work to assure their long-term sustainability. Markets for products made from mixed plastics will also need to be developed.

**What should the federal government do?**

Aggressive and immediate research and development efforts are needed to refine plastics recycling technologies; develop adequate, cost-effective collection systems; and build long-term local. regional, and national markets. Some state governments, in cooperation with the plastics industry. have already taken an active role. But more is needed from other state governments, from the federal government, and from industry.

Will recycling solve the problem of plastic waste? Experts differ in their estimates of the amount of plastics that can be economically recycled. Dr. Sidney Rankin of the Center for Plastics Recycling Research puts the figure at about half of all plastics. A less optimistic projection comes from T. Randall Curlee of the Oak Ridge National Laboratory who argues that only one quarter of all plastics are potentially recyclable.

Even if goals of 25 or 50 percent recycling are reached, a signficant portion of plastics will remain to be disposed of. Given that recycling is at best a partial solution, alternative methods of reducing packaging waste will have to be developed if we are to reduce our reliance on landfills and incinerators. While degradable plastics may hold some promise in certain applications. encouraging the use of other packaging materials that are naturally degradable and easily recyclable will provide a more sound long-term waste reduction solution.

Again, I thank you for inviting me to share Environmental Action Foundations concerns on plastics degradability and recycling. I would be happy to answer any questions you may have.

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Mr. Hochbrueckner. Excuse me for just a moment while we go vote. Voters have a way of expecting us to vote when we're in Washington, so we must do that.

Let me adjourn this meeting for a few minutes until the chairman returns.

[Recess.]

Mr. Hochbrueckner. Ms. Wirka, what I'd like to do at this point is call on Mr. Toner to address us and after Mr. Kirkpatrick has also talked to us, then I'd like to have a little conversation about striking the balance between recyclability and degradability because obviously that's what this is all about. You have to strike balances and clearly we'd appreciate your inputs on that.

At this point, Mr. Toner, I'd like to recognize you for your remarks, and Ms. Wirka, let me assure you that your written statement will become part of the official record.

Mr. Toner.

Mr. Toner. Thank you.

The Society of the Plastics Industry appreciates the opportunity to express its views on H.R. 5000. SPI commends the sponsors of H.R. 5000 for recognizing the need for studies of the technologies to help address the solid waste management problem facing the country.

However, there are three major government studies currently under way which will address this particular question. Therefore, we think it's premature to mandate additional studies until the current studies have been reviewed. A draft report of the EPA's Solid Waste Task Force is expected to be published for public review and comment within a month. EPA's expected to hold public hearings and to finalize the report by the end of the year.

The Office of Technology and Assessment is working on a congressionally requested study and one of the requesters was this same House committee on essentially the same subject. The OTA report is to be completed by the spring of 1989.

Lastly, EPA is conducting a congressionally mandated study to look specifically at the role of plastics in the municipal solid waste stream, focusing in particular on plastic recycling and degradable plastics. That report's due in July of 1989. All three are due within 12 months.

Notwithstanding our view that consideration should be delayed, there are certain features of the bill on which we have particular comment. An apparent decided premise of the bill is that the only acceptable way of handling waste in the future is to recycle the waste or have it degrade. The committee chairman, in his opening remarks, noted that solid waste experts agree that a combination of approaches must be incorporated into a broad plan. That combination includes recycling, safe incineration and environmentally secure landfill.

Safe incineration must play a large role in our future waste management plans. For example, New Jersey, a State with a landfill crisis, has established a target waste management mix of 25 percent recycling, 10 percent landfill and 65 percent incineration.

SPI also objects to including in a study, bill provisions which presume the need for product bans or regulation before the studies are completed. There's no logical or scientific foundation at this time for calling for the broad prohibition of product classes or materials based strictly on their recycling or degradability characteristics.

We believe that the studies called for in the bill concerning the wider use of degradable materials is too narrow. The studies must be broadened to address the questions of whether degradability in certain products and certain circumstances is an acceptable attribute or has adversely affected other critical functions of the product or is even an environmental benefit.

A previous speaker noted that little was known about the environmental fate of products which degrade in the environment, plastics or otherwise.

Plastics—two broad approaches are being pursued to make plastics more degradable in the environment: photodegradation and biodegradation. It's important to note that within these two broad approaches, there are several different technologies for each. Some of the speakers on the following panel will address their particular types of technologies.

Additional information on these technologies, though, has been submitted in our written comments.

The use of degradable plastics should be considered only if it contributes to a practical environmentally sound solution to the problem being addressed. For example, litter is that part of the solid waste stream that almost literally falls outside of the municipal waste management system. Photodegradation does respond, at least partially, to the problems encountered when a product is littered.

Biodegradable products may also address litter, but it is not at all clear what role these materials should play, if any, in an integrated solid waste management system.

Degradation of any material in a landfill is, in fact, a very complex and slow process. Many materials generally regarded as degradable deteriorate either slowly or not at all in a landfill. The Congressman will be happy to know that EPA studies on the composition of the solid waste stream on a national basis have essentially the same kinds of numbers that he showed for Long Island.

These figures would indicate that over 60 percent of the materials going into landfills, one would consider to be degradable, yet we still have the landfill crisis.

H.R. 5000 calls for study of the use of degradable materials in medical equipment, supplies, and in items procured by the Department of Defense. SPI certainly believes that further study on appropriate uses of degradable materials is in order.

Further, an area of special study is the potential effect that the increased use of degradable materials could have on recycling. Plastics recycling programs are being implemented in numerous communities nationwide.

Last year, over 150 million pounds of post-consumer plastics were recycled into durable products, such as carpeting, geotextiles and, as the Congressman noted, plastic lumber. Good public policy should ensure that increased use of degradable materials does not have a negative impact on recycling.

H.R. 5000 also calls for research on recycling technology and markets for recycled products. SPI obviously agrees that continued and additional research is necessary in the area of plastics recycling, especially in the areas of collection systems and in end-use markets.

Rather than establish an Office of Recycling Research and Information, EPA favors the more positive joint government/industry academia approach incorporated in H.R. 4454. H.R. 4454 would establish the Center for Plastics Recycling Research at Rutgers University as the National Center for Plastics Recycling. It would also require the center to select four other colleges or universities to assist in conducting research activities.

The Center for Plastics Recycling Research was established in 1985 by the Plastics Recycling Foundation, which SPI helped establish. The Recycling Foundation is an independent, nonprofit organization whose members include manufacturers of plastic products and resins, package goods companies, soft drink companies and others interested in recycling.

The Federal Government is already playing an important role with the many studies that have been initiated to better define the solid waste problem and evaluate the merits of different approaches. In so doing, the Federal Government is helping bring focus to an increasingly complicated and often confusing picture of the solid waste problem and proposed solid waste solution.

In summary, SPI commends the sponsors of H.R. 5000 for recognizing the need for more information. We would suggest that the studies that H.R. 5000 suggests be delayed until the current studies that are under way have been published and are reviewed.

The plastics industry is continuing to develop the technology and means to recycle post-consumer plastics. It is clear that the plastics industry has interest in developing degradable plastic products which will find their niche in satisfying appropriate environmental and marketplace needs.

Prudent public policy should ensure that plastics recycling and degradability are compatible and contribute to the maximum long-term environmental and social benefit.

Thank you.

[The prepared statement of Mr. Toner follows:]

The Society of the
Plastics Industry, Inc.

1275 K Street, N.W., Suite 400
Washington, D.C. 20005
(202) 371-5200

**Statement**

**of**

**Hugh Patrick Toner**
**Director, Technical and Regulatory Affairs**

**for**

**The Society of the Plastics Industry, Inc.**

**before**

**The House Science, Space and Technology Subcommittee on Natural Resources, Agriculture Research and Environment**

**United States House of Representatives**

**August 10, 1988**

*For further information contact:*

*Margaret Rogers*
*Director, Federal Government Affairs*
*The Society of the Plastics Industry*
*1275 K Street, N.W., Suite 400*
*Washington, D.C. 20005*
*(202) 371-5282*

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The Society of the Plastics Industry, Inc. (SPI) appreciates the invitation of Representative Scheuer, Chairman of the Subcommittee on Natural Resources, Agriculture Research and Environment, to express its views on HR 5000, the "Recyclable Materials Act of 1988."

SPI is a trade organization of more than 2000 members representing all segments of the plastics industry in the United States. SPI's operating units and committees are composed of resin manufacturers, distributors, machinery manufacturers, plastics processors, moldmakers, and other industry-related companies and individuals. Founded in 1937, SPI serves as the "voice" of the plastics industry.

## INTRODUCTION

SPI commends the sponsors of HR 5000 for recognizing the need for studies of technologies to help address the solid waste management problems facing the country. However, given the soon-to-be-completed, comprehensive EPA Task Force report on strategies for managing municipal solid waste, SPI believes it is premature to call for specific additional studies at this time. A draft of the EPA Task Force report is expected to be published for public review and comment within a month. EPA is expected to hold public hearings around the country to receive comments on the draft report which is to be finalized by the end of the year.

Further, the Office of Technology Assessment (OTA) is also working on a study, at the request of the Senate Environment Committee on

Environment and Public Works, the House Committee on Energy and Commerce, and the House Committee on Science, Space, and Technology, on essentially the same subject. The OTA report, which will evaluate how different technologies for reducing and managing solid waste can be used in an environmentally and cost-effective long-term solid waste strategy, is due to be completed by Spring 1989.

Lastly, the EPA is conducting a Congressionally-mandated study to look specifically at the role of plastics in the municipal solid waste stream focusing in particular on plastics recycling and degradable plastics. This latter report is due in July 1989.

Notwithstanding our view that consideration on the bill should be deferred because of these ongoing studies addressing issues raised in the proposal, there are features of the bill on which SPI has comments.

An apparent decided premise of the bill is that the only acceptable way of handling waste in the future is to recycle the waste or to have it degrade in a landfill. The bill's premise is in profound conflict with the views of all solid waste experts - local, state and federal. All agree that a combination of approaches must be incorporated into a broad plan of action for any community that involves recycling, safe incineration and environmentally secure landfilling. Incineration must play a large role in our future waste management plans. For example, New Jersey, a state with a landfill crisis, has established a target waste management mix of 25% recycling, 65% incineration and 10% landfill.

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In addition to objecting to the premise of the bill, SPI objects to including, in a study bill, provisions specifying product prohibitions and the designation of "non-recycled consumers goods," "regulated items," and "naturally degradable materials." Although these provisions do not take effect for five years, after completion of the studies called for in the bill, there is no logical or scientific foundation at this time for calling for the prohibition of broad classes of products or materials based on recycling or degradability characteristics.

## DEGRADABLE MATERIALS

SPI believes that the studies called for in the bill concerning the wider use of degradable materials are too narrow. The studies must be broadened to address the question of whether degradability of certain products in certain circumstances is an acceptable attribute of the product, or has not adversely affected other critical functional attributes of the product, or, is an environmental benefit. Little is known at this time about the environmental fate of products which degrade in the environment, plastics or otherwise.

Plastic products are chosen because of their specific and, in some cases, unique physical and/or chemical properties, overall design and performance characteristics, including consumer safety, and economics. The imposition of an additional requirement or expectation such as degradability should not be made without considering the impact it would have on the other factors which lead to the choice of a plastic product in the first place.

At this point, it is important to note that, for plastics, two broad approaches are being pursued to make certain plastics more degradable in the environment. One approach is to significantly increase and accelerate the degradation that occurs when plastics are exposed to ultraviolet (UV) light. This process is called photodegradation. The other approach, biodegradation, is to include biodegradable constituents in the plastic, sometimes with additional additives to enhance degradation, or in one case, to utilize a polymer which is a fermentation product of sugar and fatty acid feed stocks. Biodegradation implies that bugs or micoorganisms consume or otherwise degrade the material.

It is important to note that within these two broad approaches, photodegradation and biodegradation, there are several different technologies. Additional information on these technologies is included in my July 26, 1988 statement before the joint hearing of the House Merchant Marine Subcommittee on Fisheries and Wildlife Conservation and the Environment and the House Energy and Commerce Subcommittee on Commerce, Consumer Protection and Competitiveness, and in "An SPI Overview of Degradable Plastics," copies of which are attached.

The use of degradable plastics should be considered only if it contributes a practical, environmentally-sound solution to the problem

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being addressed. For example, litter is that part of the solid waste stream that, almost literally, falls outside of the municipal waste management system. Photodegradation does respond, at least partially, to the problems encountered when a product is littered. Photodegradable products can reduce the persistence of litter, thereby reducing the long-term unsightliness and entanglement hazards associated with litter. Photodegradation should be considered for those items which have a high potential for becoming litter.

Biodegradable products may address litter, but it is not at all clear what role these materials should play, if any, in an integrated solid waste management system. Degradation of any material in a landfill is, in fact, a very complex and slow process. Many materials generally regarded as degradable deteriorate either slowly or not at all in a landfill. For example, studies conducted for EPA on the composition of the solid waste stream indicate that over 60 percent of the materials currently being landfilled would be considered to be degradable (food wastes, yard wastes, paper and paperboard, etc.) yet there is a landfill shortage. Decomposition of paper is significantly retarded if it is coated or heavily printed. For example, newspaper print can be read easily after ten years in a landfill.

HR 5000 calls for studies of the use of degradable materials in medical equipment and supplies and in items procured by the Department of Defense. SPI certainly believes that further study on appropriate uses of degradable materials is in order. Further, an area in need of special study is the potential effect that the increased use of degradable materials could have on recycling. Plastics recycling programs are being implemented in numerous communities nationwide. Last year over 150 million pounds of post-consumer plastics were recycled into durable products such as carpeting, geotextiles, and plastic lumber. Good public policy should ensure that the increased use of degradable materials does not have a negative impact on recycling.

## RECYCLING

HR 5000 calls for research on recycling technology and markets for recycled products. It also calls for separation, recovery and utilization of plastics from a composting pilot program. SPI agrees that continued and additional research is necessary in the area of plastics recycling, especially in the areas of collection systems and in end-use markets.

Rather than establish an office of Recycling Research and Information within EPA, SPI favors the more positive joint government/industry approach incorporated in HR 4454, "The Recycling Act of 1988." HR 4454 would establish the Center for Plastics Recycling Research as the National Center for Plastics Recycling. It also would require the Center to select four other colleges and universities to assist in conducting research activities.

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The Center for Plastics Recycling Research was established at Rutgers University in New Jersey by the Plastics Recycling Foundation. The Plastics Recycling Foundation, which SPI helped establish, is an independent non-profit organization whose members include manufacturers of plastic products and resins, packaged goods companies, soft drink companies, and others interested in recycling.

## FEDERAL ROLE

The Federal government is already playing an important role with many of the studies that have been initiated to better define the solid waste problem and evaluate the merits of different approaches. The Federal government in so doing is helping bring focus to an increasingly complicated and confusing picture of the solid waste problem in the country. This vital contribution of providing clarity to the problem, and, ultimately, direction for solutions, could be undone if bills such as HR 5000 were prematurely acted upon. They could unintentionally undo the good work that is being done by OTA and EPA.

## CONCLUSION:

In summary, SPI commends the sponsors of HR 5000 for recognizing the need for more information and research on the technologies that will help address the country's solid waste management problems. The three major federal government studies discussed above, soon to be published, will address these issues and the appropriate role of

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plastics in the responses to them. SPI believes it is premature to mandate additional studies until the results of the studies, currently underway, are reviewed.

The plastics industry is continuing to develop the technology and means to recycle post-consumer plastics. It is clear that there is plastics industry interest in developing degradable plastic products which will find their niche in satisfying appropriate environmental and marketplace needs. Prudent public policy should ensure that plastics recycling and degradability are compatible and contribute to the maximum long-term environmental and social benefit.

Mr. HOCHBRUECKNER. Thank you, Mr. Toner.

In just a quick response, rather than save questions until all three of you are done, since we've been disjointed already with the votes, let me just point out a couple of items.

First off, I don't regard that there is—I don't see any real conflict between the three studies that you cited and this legislation. In fact, I would assume that under this legislation, the Commerce Department, with the EPA, would, in fact, utilize those three studies in order to ultimately formulate the list. And I think the timing would fit, too, in terms of when this legislation might, in fact, take effect relative to when those three reports would be available.

Secondly, your point is well taken about a balanced approach in terms of recycling, degradability and that third list that I mentioned that's provided for in H.R. 5000, which is the exempt list. Clearly, there are some items that should be—that are not appropriate for recycling or for degradability and therefore, landfilling, incineration, et cetera, would be appropriate. We have taken that into account.

Of course, you expressed your—I guess the concern of your industry over mandating the fate of six-pack rings, as well as plastic bags and fast-food containers, and obviously reasonable people can disagree and that's understandable.

So I thank you for your input on this and I would hope that the plastics industry would, in fact, provide to me in writing some suggestions that you might have to make the legislation better. That is, in fact, the purpose of the hearing process in any case, to improve the bill and certainly Ms. Wirka is also encouraged, as a representative of Environmental Action, to do the same in terms of written suggestions as to how we could, in fact, make the bill better and more applicable for the nation. Thank you.

Mr. Kirkpatrick, the Garbage Can and I thank you and you're up, sir.

Mr. KIRKPATRICK. Thank you very much. I'm not as accustomed as most of these other people at testifying before this sort of forum, so if I stumble along a little bit, I hope you will forgive me.

I appreciate the opportunity to be here. I, too, have some remarks that I've given to the committee and will try to summarize them.

I basically—I guess I represent a tremendous amount of frustration in the country. We're talking sort of in terms of five years or 10 years or maybe it's too early for another study and this sort of thing and yet, at the local level, the landfills are filling up; there's litter all over the countryside. You can't get an incineration facility sited. We're contaminating the aquifer and on and on and on and on.

The true, really environmental crisis has been precipitated by our ineffective attention to this problem over a period of years. This, after all, has to be accomplished at the local level. Garbage is not a Federal problem and it's really not a State problem. It's a local problem and the Federal and State Government, I feel, have a responsibility to the local governments to help them solve this problem because they're the ones that are faced with the crisis and the inability for them to get any movement in some of these areas that we've talked about today has brought them right to the brink of just not knowing what to do at all.

I think that what we have to do is recognize—the gentleman who was sitting in my seat earlier on talked about New Jersey and, you know, the people in New Jersey are now paying $150 a ton to ship their garbage to western Pennsylvania and to Ohio. It's piling up all over the place in Florida—

Mr. SCHEUER. And that's not going to last very long because western Pennsylvania and Ohio aren't going to have the landfill in a couple years to take care of them—

Mr. KIRKPATRICK. They don't want it. You know, the State—

Mr. SCHEUER. They're going to have to ship it overseas—

Mr. KIRKPATRICK. Yes, sir.

Mr. SCHEUER. —to some poor developing country who, in their poverty, feel that accepting toxic waste from abroad and burying it in their land and polluting their groundwater is the best way for them to take a step to overcome their grinding poverty. It's a pitiful situation.

Mr. KIRKPATRICK. Yes, sir, and they're at our mercy.

Basically—you know, if you take a State like Connecticut, they run out of landfill space in 1989. This is not something we can put off for five years or study for a long time if you look at the State of Connecticut. New Jersey's got one landfill left. Florida will lose a third or half of its landfills. Currently, 33 of our 67 counties are under the final extension of a consent order from the Department of Environmental Regulation to close the landfills.

We have 35 million tourists a year in Florida. I'm sure almost everybody in the room has been to Florida at one time or another. Our tourist economy is tremendously important to us. Litter and garbage spread all over the lakes and the streams and the parks and the highways is a big problem for Florida and we need to do something about it, you know, in sort of a short-term agenda.

Now, we realize that there are a lot of hoped-for solutions, but by the time these hoped-for solutions are implemented, we're going to be covered over down there.

I think that one of the things that we're asking you all to do is to try to help local governments and State Government move this process forward. We need to change the attitudes within the boardrooms of this country on manufacturing of this packaging and the merchandising habits.

Listen, one Super Bowl ad costs about $700,000. Now, we could play a game of how many of these different jingles we can remember because they've been engrained into our lifestyle by the Madison Avenue advertisers convincing us that we will absolutely not be able to survive if we don't have a hot burger and cold lettuce. Well, Florida said that that's probably not a life-or-death situation for the people in Florida. And if we have to put up with this momentarily used item, this clamshell—as soon as you fold it over, you no longer have a need for that product. It's ludicrous. We don't need to produce those and yet the industry is spending billions of dollars—well, let's say millions, I'm sure that's correct, but we could probably say billions, in trying to create new ways to cause the public to request more of these items.

Now, until the boardrooms—when they come together—put the fellow whose responsibility it is to do something about the disposal of these items they're developing on the same level of importance as the guy that comes in with the financial statement, the guy that comes in talking about the stock prices, the guy that comes in talking about the new oil field, the marketing guy that comes in with all the new products—you know, the guy that's talking about the waste solution is like that guy on Johnny Carson who, for five weeks, he keeps getting bumped back because somebody talks too long and he never gets on the program. That's basically what's taking place in the corporate boardroom.

I sympathize with SPI because they can't get their members' boards together to recognize that until three years ago, they relied on incineration. They're not going to be able to rely on incineration to be the sole way that we're going to solve the plastic litter and volume reduction problem. That's what they relied on until about three years ago.

Now, all of a sudden, they recognize they're going to have to do something else, and they're not moving fast enough. We started in June of 1987 to work on this bill. We never got the plastics industry to even condescend to show up until January, and then we asked them for some help. Actually, we came to New York, the Recycling Conference, and asked them to help us out with our problem. They promised to help, and 60 days later, two days before we went into session in Florida, we finally heard from them, and they sent us a little thing about labeling, voluntary labeling program.

We don't have a voluntary labeling program in Florida; it's going to become mandatory because if we're going to have successful recycling, it's going to have to be that way.

Now, I know I've run out of time. I need to rush through and ask you for two serious requests for the States. I'll cut through all this other stuff. I'd like to say that Florida, our law says that—that degradable plastic packaging is mandatory in the State of Florida after FDA approval and commercial availability. We didn't mince a lot of words.

Suffolk County, New York, hasn't minced a lot of words. You know, we've got people all over the country responding to the citizen outcry to do something about plastic packaging and I can tell you that the elected officials all over the country are recognizing that this, becoming a bigger and bigger issue.

FDA approval is something that, I don't know, statutorily your technicians could help us out, but I think it's supposed to take six or eight months, and it usually now takes about 14 to 18 months. We're hopeful that this committee and the Congress of the United States will give some assistance to the States who are struggling with this issue and are having to make some decisions themselves to move this process along. That would be very helpful for us.

We have the problem with EPA on another issue trying to decide how—what they're going to do about ash from incinerators. You know, you've got millions and billions of dollars worth of investments at the local level that are absolutely at a standstill with the interest clock running and the bond rates going up, which has a tremendously disastrous impact on local government, waiting on EPA to decide how they're going to treat the ash.

Now, one of the things this committee could do as an offshoot of this discussion and the other ones that you all are working on, will be to prod EPA to move them along to at least let us know what they're going to do, so that we can make some decisions and local government can move forward.

Finally, one of the methods—and you know, everybody's struggling to find revenue sources to solve these problems—one of the methods that the States are able to use is the oil overcharge moneys. You know, when we're talking about recycling, we're talking about energy conservation. A lot of the other things that we're doing, coal generation, coal burning, garbage incineration to produce electricity, all these things, this is energy conservation.

Now, in Florida's case, we have $90 million that is set aside for the State of Florida to come back to the people in the State of Florida. The biggest single problem we have, other than education and health services in Florida, is garbage, and if we could get the Federal agencies that are making the decisions on this to give us a little slack on how we could use this money through the Exxon funds or the stripper funds—the stripper funds are a little less complicated than the Exxon funds—then we would be able to take this resource from the State level and get some things done.

I think Connecticut finances its entire program out of the stripper funds. Florida has a request in for $17 million to be able to do its program out of the same basis.

Finally—and I know I'm over my time—I came a long way—two weeks ago, I was in Reno, Nevada, and the National Conference of State Legislature met out there. And two of the most heavily attended meetings in that congregation of State legislators from all over the country were workmen's compensation—what we're going to do about it at the State level—health care, indigent health care and garbage, solid waste disposal/recycling/litter.

The Environmental Committee of the National Conference of State Legislatures has developed a policy on solid waste management and it has several requests of Congress to help us out. I won't take the time to read them, but I would like to—I can't think of a better way to help us get our request into the process than to, you know, give them to this committee and let you take them and see what, you know, needs to be done about the distribution.

The States, you know, are just basically—have run out of options in some areas and we're going to depend on you all to help us out.

I appreciate it very much.

[The prepared statement of Mr. Kirkpatrick follows:]

August 10, 1988

## REMARKS BY FLORIDA STATE SENATOR GEORGE KIRKPATRICK BEFORE THE HOUSE SUBCOMMITTEE ON SCIENCE AND TECHNOLOGY

THANK YOU FOR THE OPPORTUNITY TO APPEAR BEFORE YOU TODAY AND PROVIDE TESTIMONY ABOUT OUR FLORIDA EXPERIENCE WITH SOLID WASTE MANAGEMENT. FOR YOUR RECORD, I AM PROVIDING A COPY OF MY REMARKS AND A COPY OF A SUMMARY OF THE RECENT SOLID WASTE MANAGEMENT LEGISLATION PASSED IN FLORIDA IN JUNE 1988.

TO BETTER UNDERSTAND FLORIDA'S PROBLEMS, LET ME REFER YOU TO SEVERAL NOTEWORTHY FACTS CONTAINED IN AN ARTICLE IN THE ST. PETERSBURG TIMES NEWSPAPER EARLIER THIS YEAR.

1. IN ANY NUMBER OF WAYS, SOLID WASTE IS TROUBLE. IT'S A POTENTIAL MENACE TO DRINKING WATER WHEN IT'S DUMPED OR TO THE FRESH AIR WHEN IT'S BURNED. THE COST OF COLLECTION AND DISPOSAL IS SKYROCKETING. EVEN IN RURAL COUNTIES WHERE LAND IS PLENTIFUL AND GARBAGE IS NOT, THE

COST OF MAINTAINING A LANDFILL SOMETIMES OUTSTRIPS THE ABILITY TO PAY FOR IT. IN URBAN COUNTIES, WHERE GARBAGE IS PLENTIFUL AND LAND IS NOT, THE ALTERNATIVE IS WASTE-TO-ENERGY FACILITIES WHICH CAN COST $100 MILLION PER 1,000 POUNDS PER DAY CAPACITY.

2. SOLID WASTE MANAGEMENT IN FLORIDA IS PARTICULARLY VEXING. THIS IS A STATE THAT JUTS OUT INTO THE SEA, WHERE PEOPLE CLUSTER ALONG THE COASTLINE, AND VITAL SWAMPS AND AQUIFERS CLAIM THE INLAND. IT IS A FRAGILE LAND, WHERE LANDFILLS BECOME MOUNTAINS, STACKED ABOVE THE THIN SOIL BARRIER THAT PROTECTS THE DRINKING WATER BELOW. FLORIDA IS WHERE 48 OF THE 175 DISPOSAL SITES ARE SUSPECTED OF POLLUTION, WHERE ONE RECENT STUDY IN SOUTHEAST FLORIDA FOUND DANGEROUS UNDERGROUND CONTAMINATION FROM 32 OF 38 ACTIVE AND INACTIVE DISPOSAL SITES.

3. THERE IS ONLY ONE GOOD SOLUTION TO SOLID WASTE, AND THAT IS TO SIGNIFICANTLY REDUCE THE VOLUME. ESSENTIALLY THAT

IS THE CHALLENGE FOR FLORIDA. CHANGES ARE NEEDED IN MANUFACTURING AND MERCHANDISING HABITS AND THROUGH BROAD PROGRAMS OF LOCAL GOVERNMENT SPONSORED RECYCLING, THE STATE MUST SLOW ITS STREAM OF WASTE.

4. AS FLORIDA CLIMBS TOWARD BECOMING THE THIRD MOST POPULOUS STATE IN THE NATION, IT HAS YET TO FACE WHAT THE SECRETARY OF THE DEPARTMENT OF ENVIRONMENTAL REGULATION HAS CALLED "THE MOST NEGLECTED PROBLEM IN THE STATE."

IN 1987, THE PRESIDENT OF THE FLORIDA SENATE RECOGNIZED THAT THE DISPOSAL OF SOLID WASTE WAS A PROBLEM THAT NEEDED TO BE ADDRESSED BEFORE IT REACHED CRISIS PROPORTION. SENATE PRESIDENT JOHN VOGT APPOINTED A SELECT COMMITTEE ON SOLID WASTE TO STUDY THE SOLID WASTE PROBLEMS IN FLORIDA AND TO PROPOSE SOLUTIONS WHICH WOULD BE HANDLED THROUGH LEGISLATION.

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THE SENATE SELECT COMMITTEE THAT WAS CREATED REVIEWED THE SOLID WASTE PROBLEMS AROUND THE STATE AND SOUGHT SOLUTIONS FROM LOCAL OFFICIALS AND PEOPLE IN THE PRIVATE SECTORS WHO ARE INVOLVED WITH VARIOUS ASPECTS OF SOLID WASTE MANAGEMENT, INCLUDING RECYCLING. SOME OF THE STARTLING FINDINGS OF THE SELECT COMMITTEE ILLUSTRATED THE TREMENDOUS VOLUMES OF SOLID WASTE THAT MUST BE HANDLED BY LOCAL GOVERNMENTS IN FLORIDA, AS FOLLOWS:

a. DADE COUNTY PROCESSES ENOUGH SOLID WASTE TO FILL THE ORANGE BOWL THIRTEEN TIMES A YEAR.

b. JACKSONVILLE PROCESSES ENOUGH SOLID WASTE TO FILL THE GATOR BOWL EVERY 22 DAYS.

c. APPROXIMATELY ONE-THIRD OF THE LANDFILL SPACE IN FLORIDA THAT WAS AVAILABLE IN 1985 WILL BE CLOSED BY 1996.

d. IN 1985, 18 FLORIDA COUNTIES REPORTED THAT THEY WOULD BE CLOSING ALL THEIR EXISTING LANDFILL ACREAGE BY 1996.

e. AT THE CURRENT RATE OF LANDFILLING IN FLORIDA, 64,000 MORE ACRES OF LANDFILLS WOULD BE NEEDED BY 1997.

DURING THE COURSE OF INVESTIGATION, THE SENATE SELECT COMMITTEE FOCUSED ON SEVERAL KEY AREAS:

1. WASTE MINIMIZATION;
2. CONSERVATION OF LANDFILL SPACE;
3. CONSERVATION OF WASTE-TO-ENERGY FACILITY CAPACITY;
4. RECYCLING;
5. LITTER CONTROL;
6. FULL COST ACCOUNTING FOR SOLID WASTE SERVICES;
7. INCENTIVES FOR RECYCLING;
8. INCENTIVES FOR INVESTMENT IN RECYCLING MACHINERY AND EQUIPMENT;
9. RESEARCH;

10. TRAINING FOR SOLID WASTE MANAGEMENT FACILITY OPERATORS; AND

11. A TREND TOWARD DEGRADABLE MATERIALS FOR PACKAGING.

[redacted] LEGISLATION WHICH PASSED [illegible] WAS A COMPROMISE BETWEEN THE HOUSE AND SENATE SOLID WASTE BILLS. WITHOUT A DOUBT, THIS 1988 LEGISLATION [illegible] EVENTUALLY TOUCH THE LIFE STYLE OF EVERY FLORIDIAN.

OUR 1988 SOLID WASTE LAW IS VERY COMPREHENSIVE IN ITS SCOPE AND COVERAGE, AS YOU CAN SEE FROM THE SUMMARY I'M LEAVING FOR YOUR RECORDS.

TODAY, I WOULD LIKE TO FOCUS MY REMARKS ON THE SPECIAL CONCERNS ABOUT PLASTICS, POLYSTYRENE FOAM, AND EXCESSIVE PACKAGING. THESE ITEMS CREATE SPECIAL SOLID WASTE MANAGEMENT PROBLEMS. A NUMBER OF STATES ARE ATTEMPTING TO DEAL WITH THESE MATTERS, BUT I BELIEVE IF THESE PROBLEMS ARE GOING TO BE SOLVED, FEDERAL LEGISLATION WILL BE NEEDED, ESPECIALLY ON THE EXCESSIVE PACKAGING. ONLY CONGRESS HAS

ADEQUATE POWER TO DEAL WITH THE INTERSTATE COMMERCE FEATURE AND IS POWERFUL ENOUGH TO GET THE ATTENTION AND COOPERATION OF MADISON AVENUE'S MARKETING STRATEGIES.

[illegible] [illegible]S MADE FROM PL[illegible] [illegible] NOT [illegible] [illegible] THE SOLID WASTE STREAM, THEY CREATE SPECIAL PROBLEMS. [illegible]STYRENE FOAM PRODUCTS, FOR ALL [illegible] CONVENIENCE, CAUSE A MAJOR LITTER PROBLEM IN OUR LAKES AND RIVERS AND ON OUR BEACHES. BITS AND PIECES OF STYROFOAM CUPS AND BURGER BOXES ARE PERCEIVED BY PEOPLE AS INCOMPATIBLE WITH THE AESTHETIC VALUES OF OUR NATURAL RESOURCES. THE INDUSTRY HAS BEEN RELUCTANT TO INTRODUCE MATERIALS THAT WOULD MAKE POLYSTYRENE PRODUCTS DEGRADABLE. IF THESE PRODUCTS WERE DEGRADABLE, THEY WOULD NOT BE PERCEIVED AS SO INCOMPATIBLE WITH OUR ENVIRONMENT.

OUR NEW FLORIDA LAW REQUIRES DEGRADABLE POLYSTYRENE FOAM PRODUCTS TO BE USED WITHIN 12 MONTHS AFTER THE FOOD AND DRUG ADMINISTRATION APPROVES THE MATERIALS THAT PROMOTE THE DEGRADABILITY FEATURE. THESE MATERIALS ARE ALREADY IN USE

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IN CANADA. ANYTHING THIS COMMITTEE CAN DO TO ACCELERATE THE FDA CONSIDERATION OF THESE MATERIALS IN THE U. S. WILL BE APPRECIATED IN FLORIDA.

[illegible] INDUSTRY HAS [illegible] CHLOROFLUORACARBONS IN THEIR FORMING PROCESSES. [illegible] TESTIFIED BEFORE OUR LEGISLATIVE COMMITTEE [illegible] BEING MORE ENVIRONMENTAL RESPONSIVE BY THEIR ACTIONS. THESE ACTIONS WERE TOO LITTLE, TOO LATE. THE FLORIDA INDUSTRIES TESTIFIED THAT NO ONE IN THE STATE WAS CURRENTLY USING CFC'S IN THEIR FORMING PROCESSES.

THE PLASTICS INDUSTRY WOULD HAVE US BELIEVE THAT THEY ARE RECYCLING MORE OF THEIR PLASTIC PRODUCTS. THEY FAIL TO TELL US THAT THE PERCENTAGE BEING RECYCLED AS A PERCENT OF THE TOTAL AMOUNT OF PLASTIC PRODUCTS IS EXPECTED TO ACTUALLY DECLINE IN FUTURE YEARS. CONGRESS NEEDS TO DETERMINE IF THIS INDUSTRY IS MEETING ITS CORPORATE RESPONSIBILITIES IN THE RECYCLING OR DISPOSAL OF ITS PRODUCTS WHEN COMPARED WITH THE ENORMOUS PROFITS THE INDUSTRY IS REALIZING. IT HAS BEEN

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REPORTED THAT IN 1986, 13 BILLION POUNDS OF PLASTICS WERE USED IN PACKAGING IN THE UNITED STATES. THIS AMOUNT IS EXPECTED TO INCREASE SIGNIFICANTLY IN FUTURE YEARS. IT MAY BE TIME THAT FEDERAL LEGISLATION COME FORWARD TO HELP STATES DEAL WITH PLASTICS IN OUR WASTE STREAM.

THIS LOOSELY ALIGNED INDUSTRY GROUP HAS BEEN SLOW TO COME FORWARD WITH SOLUTIONS TO THE PROBLEMS CREATED BY PLASTIC PRODUCTS. THEY SEEM TO RESPOND ONLY WHEN FEDERAL OR STATE LEGISLATION COMES FORWARD.

I URGE THIS COMMITTEE TO HELP PROD THESE CORPORATE BOARDS INTO ACTION. ALSO, THIS COMMITTEE CAN HELP PROD THE ENVIRONMENTAL PROTECTION AGENCY INTO A RESOLUTION OF THE ASH DISPOSAL ISSUE - ANOTHER ITEM OF CONCERN IN FLORIDA AND OTHER LARGE URBAN AREAS USING INCINERATION FACILITIES FOR THEIR SOLID WASTE. THEIR DELAY HAS CREATED MUCH UNCERTAINTY AND EXPENSIVE DELAYS IN PROJECTS.

FINALLY, I URGE YOU TO TAKE A LOOK AT THE BUREAUCRATIC HURDLES THE U. S. DEPARTMENT OF ENERGY IS USING TO DELAY STATES IN USING MONIES FROM THE OIL OVERCHARGE SETTLEMENT LITIGATION. FLORIDA PLANS TO USE SOME OF THESE FUNDS IN INITIATING PROGRAMS UNDER OUR NEW SOLID WASTE LAW. THERE WILL BE ENERGY SAVINGS - BUT WE ARE CURRENTLY GOING THROUGH A PAPER JUNGLE TO GET TO FUNDS WHICH SHOULD BE FLORIDA'S MONEY FOR THE NEEDS OF FLORIDIANS. THERE SHOULD BE MAXIMUM FLEXIBILITY IN HOW THE STATES GAIN ACCESS TO THESE FUNDS.

s;s/Remarks
(dl)

Mr. HOCHBRUECKNER. Thank you, Senator. We will certainly submit that information for the record, as well as Mr. Toner's and, of course, Ms. Wirka's.

Let me reiterate what I had mentioned earlier. Certainly, as the sponsor of H.R. 5000, I would be pleased to accept any specific suggestions you might have in terms of how H.R. 5000 could be improved to make it a better bill and so we thank you very much for your attendance and we look forward to your submission.

Mr. SCHEUER. Mr. Chairman, may I ask the witnesses a question?

Mr. HOCHBRUECKNER. Absolutely, Mr. Scheuer.

Mr. SCHEUER. Mr. Toner, you've expressed some reservations, and they may be very well taken, about this bill. You prefer to leave the initiative in the private sector. This committee has always encouraged the private sector to get into the ballgame. You know, we have the saying that we've all heard for decades, "Better living through chemistry." And all of these products that now are proving to be so environmentally degrading and are posing such a tremendous problem to society were products that the public wanted and the public valued.

We don't think industry produced plastics so that they would pollute our oceans. That wasn't the purpose, and the chemical industry didn't produce chemicals that later became toxic wastes for the purposes of polluting our groundwater.

The chemicals and the plastics were all produced to serve a positive function in society and to produce services and facilities and products that American consumers wanted and valued. Okay?

Now, this is the great law of unintended consequences coming into effect. We found, after years of using these products, that there's a pricetag on progress and that pricetag here is—is a very severe environment problem.

Now, we think that the same talent that created these products, the same engineering and scientific genius that created all those products, should be harnessed to the solutions. George Hochbrueckner happens to be a very talented and skilled engineer. I'm not. I was a classics major in high school and college. I studied Latin and Greek. I don't know how, to what extent they may—that background may have fitted me to be a legislator, for better or worse, I'm here—but I can tell you that most members of Congress are not as technically qualified as my colleague, George Hochbrueckner, is to come up with technical solutions.

We need the genius of industry that created these products in the first place to help us come up with answers to these problems that nobody anticipated originally. You know, we're all innocent of any ulterior or evil purpose in the inception, but now we've got a real problem on our hands.

Government has to be part of the solution, but we think industry ought to be part of the solution too. We don't want any more confrontation. We've had confrontation between government and industry in almost every aspect of the EPA's jurisdiction. But now we're coming to the point where we understand that a little cooperation, you know, takes some of the sting and the rancor out of the discussion and the discourse.

We have the health effects industry—the Health Effects—what is it—Institute, I guess, that was set up by the automobile industry and by EPA to study how the automobile and the internal combustion machine can be made a less environmentally degrading factor in our society and they're working very constructively together. EPA and the automobile industry.

And we've seen the chemical industry join with EPA in the production—in an outfit called Clean Sites—S-i-t-e-s—Inc., and the scientific talent in the chemical industry is working with the—with scientists at EPA to produce a solution.

I don't think it's really—your most helpful posture is to sit back and say, "Government, just relax and wait for us. We're going to come up with the answers." Maybe you will and maybe you won't, but it seems to me that ought to be a joint effort.

What we would very much welcome is some initiative—some initiative on the part of the Society of the Plastics Industry to join with us in finding out where the problems are and where the answers are. For example, we heard Congressman Courter of New Jersey, a very brilliant member of this Congress, talk to us about his fears as to what the environmentally polluting components of these biodegradable plastics might be when they degrade. Okay?

Have you got any answers for us? It seems to me that your institute ought to be mobilized—the Society of the Plastics Industry—your society ought to be mobilizing scientific talent within your industry to tell us the kind of regulation, the kind of game plan that you would find helpful and supportive, not oppressive.

We don't want to oppress your industry; we want to support it. We want to be helpful; we want to provide a framework in which you can function. And it seems to me that you, representing the Society, ought to be sitting down with George Hochbrueckner and myself and officials from EPA to see how we can pool the talent that's out there, the very talent that created these wonderful products that now are having unforeseen and unpredicted environmental impacts that we all want to get a handle on.

You see? So please think about how we can work together. Don't tell George Hochbrueckner to delay this thing for a couple of years. Time is running fast and industry cannot always be relied on to—individual industries, individual corporations cannot always be relied on to help us toward an answer. Market forces can't be relied on to bring biodegradable plastics to the consumer without some kind of government support.

Let me cite a recent article in the Wall Street Journal. This cites the Dow Chemical Company as having been in the business of making biodegradable six-pack rings for years. And they've done that to meet some very tough State laws, and I applaud them for doing that. Despite all the obvious environmental benefits of putting these biodegradable plastics into the stream of commerce, we understand—and this article documents that Dow has repeatedly refused to sell its biodegradable plastic for other uses because "Dow is fearful of endangering the market for conventional plastics." And a Dow official is further quoted in the article as saying that, "Marketing the photodegradable plastic more widely would only play into the hands of the anti-plastic movement."

Now, there is no anti-plastic movement that I know of. There is a pro-environment movement that's trying to create a product that we hope the present chemical and plastics industry will produce, which would be a non—a biodegradable benign plastic that we can use in containers and that will be photodegradable and biodegradable and—what's—and microdegradable. Do you understand?

So, help us. Let's join together. We cannot always rely on market forces. The Dow Chemical Company in—what's the name of the town in Michigan—Midland, Michigan, when we were worried, terribly worried about dioxin, refused to permit the EPA to come on its land to measure the dioxin that that plant in Midland, Michigan, was spewing on to the land, was spewing into the Shiawassee River and was spewing into the air.

The EPA actually had to hire a helicopter to fly over that land to take some measurements of the environmental degrading effects of that land—of that plant in Midland, Michigan.

Now this is not what I would call the acme of cooperation between Dow and EPA. We can improve that. You know, I'm a graduate of the Harvard Business School. They taught me there about corporate statesmanship and enlightened corporate sense of responsibility. That was 45 years ago and there have been lots of examples.

Dow Chemical Corporation was not an example of enlightened corporate statesmanship when they refused to let the EPA come onto its land or even approach in the Shiawassee River to measure those things.

We hope now that this is a comparatively new problem that we've discovered in the plastics industry that we can summon some statesmanship in the plastic industry, just as we found it in the chemical industry through Clean Sites, Inc., and in the automobile industry through the Health Effects Institute.

I'm sure—I'm confident that there's leadership in your industry that would help us work together, work together, pooling the brilliant engineering and scientific and technical talent in your industry with the talent that resides over at the EPA and some well-qualified professional talent here, and we happen to have one of them in the person of George Hochbrueckner.

So let's work together and don't—and I would hope that you wouldn't tell us to sit back in the wings for a couple of years while you work out your problem. Let's see if we can't work it out together and we would welcome an opportunity to sit down with you, your Society, representatives of the industry, representatives of EPA, to see if together we can't solve the problem and to create a regulatory framework that you will not find onerous, that you will have helped create yourself that you could live with very comfortably and that would enable the plastics industry, instead of being from an unplanned and unanticipated point of view an industry that is producing critical environmental and health problems in our country is an industry that's providing marvelous services to consumers in a fashion that is benign as far as health and environment effects are concerned.

Mr. HOCHBRUECKNER. Thank you, Mr. Scheuer.

Mr. TONER. May I respond, Mr. Chairman?

Mr. HOCHBRUECKNER. Yes, please do.

Mr. TONER. I can't speak for the Dow Chemical Company; they'll have to speak for themselves, however, that same Wall Street Journal article did mention a number of other companies who are very actively pursuing the development of either photo- or biodegradable materials.

The panel that follows this is a witness to that.

A year ago, SPI sponsored a symposium to gather what was known in the industry to make degradable plastics. The concept was first floated within the industry. There were skeptics who said "There's nothing new; nothing's going on; nobody will come; nobody cares." We had more papers proposed for that conference than we could handle in the time allotted.

A year later, we have at least three companies who are in the marketplace, building on the technology that was discussed a year ago. So I think the industry is coming forward with the things to respond to the public and environmental needs.

Part of our quandary is the balance between degradable and recyclable. Part of our quandary is the unfortunate tendency to oversimplify the complexities of the technologies that are being discussed. They have already targeted—some of the very proprietary only can work for certain things. We need to learn more about that and a rush to "let's make them all do this" without understanding whether or not they can is the concern that perhaps a company like Dow Chemical was sharing. We have all in our industry lived with that plastic-toy-that-didn't-last-through-Christmas-Day syndrome. So we are very jealous of our ability to make materials that withstand the test of time. We don't want to risk that connotation that has become attached to our products.

The Senator from Florida talked about recycling of plastic materials and it's only been three years. Well, it's been a longer—a little longer than three, but when you realize that the plastic soda bottle has only been on the market about 10 years and already over 20 percent of those bottles are being recycled, I think you can see that the industry has stepped forward to that one rather quickly.

And when you consider the amount that's been done in that 10-year period relative to some of the other materials that have been recycled for much longer periods of time, I think you'll see that our growth rate in responding to these environmental needs is much quicker than those have been in the past.

So we welcome the opportunity to work with the Congress and this particular committee and Mr. Hochbrueckner in particular. Since we share a technical background, that will make it easier for us to communicate.

So we accept the challenge and we'll willingly step up to it.

Thank you.

Mr. HOCHBRUECKNER. Very good. With Chairman Scheuer's admonition and SPI's indication of willingness to cooperate, I look forward to some very healthy inputs on H.R. 5000.

Mr. KIRKPATRICK. Mr. Chairman?

Mr. HOCHBRUECKNER. Yes, Mr. Kirkpatrick.

Mr. KIRKPATRICK. May I make a short response, please?

From the State's perspective, we're trying to make sure that on the other side of the coin in the recycling effort, which H.R. 5000 mentions also, that we try to create some markets, and everybody's mentioned all this research that's going on at Rutgers.

Florida changed the procurement policy of the State to say that we must use as a preference item articles made from commingled post-consumer recycled plastics. The problem with the research is that they haven't invested enough money to move it out of the basic phase into an applied phase.

I mean, we are willing to purchase a million and a half fence posts and a million guardrail posts and park benches and all this stuff, except this research only produces about eight an hour and it doesn't take any heavy mathematics to figure out that we won't be able to meet that market, and in the meantime, we're going to be collecting up all of this material.

One other point is that in SPI's mid-year report to its own members, it said that what they ought to do is to try to talk legislators into, as an alternative to tough packaging legislation, phasing out fully halogenated chlorofluoroalcarbon processed polystyrene. Well, you know, that's going to happen anyway. By November, there won't be anybody making that anymore. So that's just a, you know, a sop that's being thrown out.

What we're hoping that we'll be able to produce through this process is a true—as you said, Mr. Chairman—a true commitment, a quantified commitment from the industry to move us forward.

If they're recycling 300 million pounds of PET today while they're producing 13 billion pounds—and they say in five years, we'll be recycling 500 million pounds, but at the same time, the production rate goes up to 15 billion, you see that while we're recycling more and truly it is almost a 75 percent increase, the gap is widening between the amount that's being produced and I—

Mr. SCHEUER. What happens to the 80 percent that they aren't going to be recycling?

Mr. KIRKPATRICK. That's a problem that the local government and the rest of the public has to deal with.

Mr. SCHEUER. Mr. Toner, do you have any answer to that? You said, with some pride, that in another year or two, they'll be recycling 20 percent of their product? What happens—

Mr. TONER. They are now, as the Senator has said, that particular segment of the industry has committed to get it to 50 percent within five years, which is now down to four.

Mr. SCHEUER. What happens to the other 50 percent

Mr. TONER. It goes the same way as all of the other municipal solid wastes. In our view, it is landfilling. While it is a problem—

Mr. SCHEUER. We're running out of landfill.

Mr. TONER. Well, it's a problem in space that is benign in a landfill. Incineration is also a perfectly acceptable, and it should be an environmentally safe way to dispose of all municipal solid waste, including that nonrecycled plastic component.

Mr. HOCHBRUECKNER. I would just like to add, also, that in Section 2 of H.R. 5000, I specifically require that the Commerce Department work to expand the marketing of recycled products, so we try to cover all of the different aspects of not only how to divide things up, but where we go from here with the products.

Obviously, it makes no sense to get heavily into recycling when there's no place to go. That we understand.

Mr. **Kirkpatrick**. That won't just be restricted to one type of container, though, will it, Mr. Chairman, like the PET is, you know—

Mr. **Hochbrueckner**. That's the goal of this bill is to have the Commerce Department study and pull together other studies to determine where do we go from here, because obviously the high goal is recycling, but there have to be markets to use those—those products once, in fact, you've done that.

The fact that a fair amount of research has already gone into the recycling of plastics in terms of building marine structures, as well as fence posts and other things, is a good direction to go so that we do do something useful with those recycled plastics.

Mr. **Kirkpatrick**. One of the suggestions from the National Conference of State Legislators asked the EPA to fully implement its statutory responsibility to—in reference to the procurement procedure for the Federal Government, which it's never fully implemented, particularly as it relates to plastic, and I don't know if you all have had time to look into just how little they really have done as far as getting that implemented. It is not just one part of—they never have done much to get that implemented.

If you all might want to take on a little, you know, investigation, you might figure out how to get them to move that process—because that's already in the statutes. It's their statutory responsibility and that would help the States create the markets for these recycled products.

Mr. **Hochbrueckner**. Thank you very much. I thank the panel for your inputs and at this point, I'd like to turn the meeting back to the real chairman.

Oh, I will stay the temporary chairman, Mr. Chairman. Fine.

At this point, I would like to invite up the next panel, which includes Mr. Zoltan Dorko, of Environmer Enterprises; Mr. Roger Lloyd, of ICI Americas, Inc.; and Mr. Wayne Maddever, St. Lawrence Starch Co., Inc.

Mr. Maddever, did I pronounce your name right?

Mr. **Maddever**. Very good, thank you.

Mr. **Hochbrueckner**. Okay. When you have a name like mine, you try to be sensitive about other people's names.

Would you gentlemen have a preference as to who would like to go first? Fine. Then why don't we start and go left to right.

Mr. Dorko, if you would begin.

## STATEMENTS OF ZOLTAN J. DORKO, ENVIRONMER ENTERPRISES; ROGER LLOYD, ICI AMERICAS, INC.; AND WAYNE J. MADDEVER, ST. LAWRENCE STARCH CO., INC.

Mr. **Dorko**. Fine, thank you very much.

Mr. Chairman, and members of the subcommittee, I thank you for the opportunity to testify before you this morning.

As this hearing today reflects, there is an important national debate going on in this country regarding the tremendous amount of solid wastes, that we are producing and how we dispose of it. Overflowing landfills and polluted beaches are symbolic of the serious problems we face.

You are to be commended for your leadership in taking a hard look at this national problem and for your desire to move forward with reasonable legislative solutions.

It will dedicated and strong public leaders such as yourselves to resist the demand for quick fixes and, instead, to devise effective long-term solutions to this escalating problem.

Our testimony today is in relation to H.R. 5000, which proposes a multifaceted approach to this serious situation. We commend the sponsors of the bill for proposing a broad national program which will use different solutions for solid waste management and for litter, which are different parts of the overall problem.

We are especially pleased to see that the use of degradable plastics constitutes a major part of this program.

Mr. Chairman, you will be pleased to hear that at least one member of the plastics industry is doing something about it. On behalf of Environmer Enterprises, I'm here to tell you that safe, effective and economical degradable plastics are available today to help alleviate the problem of plastics litter, which is one part of the overall problem of solid waste.

Environmer Enterprises, a partnership registered in Massachusetts, is a joint venture between Polysar Incorporated, of Akron, Ohio, and the U.S. subsidiary of Eco Corporation of Toronto, Canada.

The Plastics Division of Polysar Incorporated is one of the major producers of plastics in this country. Polysar has made a corporate decision to move into environmental plastics, to address issues and concerns related to plastics in the environment.

Eco Corporation is the owner of ECOLYTE technology which was developed at the University of Toronto in Canada. This technology is state of the art for imparting photodegradability to a wide variety of plastics.

Environmer Enterprises, therefore, now has both the technology and the manufacturing capacity to service the growing market for photodegradable plastics in this country and around the world.

What are the problems of solid waste management? As a result of increasing use, plastics are becoming a focal point of the national debate on two distinct aspects of this problem: solid waste disposal and litter control.

Solid waste disposal is a complex problem which undoubtedly will require a combination of solutions such as safe incineration, recycling and improved landfill management. We wish to emphasize to the subcommittee that the use of ECOLYTE brand degradable plastics will not interfere with any of these techniques.

Litter is the second component of this problem. It is in regard to litter that degradable plastics will make the greatest contribution. Litter is a social problem. It is unsightly in our parks and on our streets. It is a potential health problem in that it can be unsanitary, as evidenced by medical products washed up on our beaches.

Litter can also be a potential hazard to wildlife, causing entanglement or ingestion, leading to starvation or choking.

Although many materials can wind up as litter, including paper, metals and wood, plastics are often singled out for a disproportionate part of the blame due to their persistence in the environment.

Even though there are several approaches that can be used to discourage litter, and despite this nation's best efforts, litter continues to accumulate on our beaches and in our streets. Ultimately, the best answer to the management of this problem includes continuing public education, cleaning up litter and using degradable materials in litter-prone products.

Of all the approaches to making plastics degradable, we believe that the ECOLYTE technology addresses the widest range of plastics products that are likely to end up as litter. The key benefits of the ECOLYTE technology include the following: One, ECOLYTE resins are safe because they are not an additive. The photosensitizing component is an integral part of the molecular structure of the polymer and it will not leach out in food or water either before or after degradation.

Two, the trigger for the degradation to begin is exposure to outdoor sunlight. Thus, an ECOLYTE product is stable as long as it is indoors, even under artificial light.

Three, the ECOLYTE degradation products are harmless and inert.

Four, ECOLYTE products are stable in landfill and compatible with recycling and incineration. Thus, they will not interfere with other waste management solutions.

Five, the use of ECOLYTE technology will not require retooling in the plastics industry. ECOLYTE resins can be used in all major plastics types, such as polyethylene, polypropylene, PET, nylon, PVC and polystyrene.

ECOLYTE technology is available now and is suitable to be used in a variety of applications, such as grocery bags like I have here, fast-food containers—and these are made with ECOLYTE—cups, plates, trays, containers, six-pack carriers, mulch film and plastic-coated products.

ECOLYTE resins do not adversely affect the basic properties of the plastic being modified and retain all of the desirable characteristics of the—for which the plastic was originally chosen in these products.

And lastly, ECOLYTE technology is economical. It only adds, for example, a fraction of a cent to the ultimate cost of a clamshell fast-food container.

Mr. Chairman, there is no doubt that the rapid increase in the volume of solid waste and the pervasive presence of litter are reaching crisis proportions in America today. To some, plastic products are seen to be a major contributor to both problems because of the rapid growth in their usage and for the very attributes that make plastics the preferred material in many applications.

However, sound waste management techniques can deal effectively with both of these problems without curtailing the use of plastics. H.R. 5000 is a good place to start this process because of its comprehensive approach.

It is our opinion that those provisions in H.R. 5000 which would require the use of degradable materials are timely and necessary. Degradable plastics are a real solution right now to the important program of litter in this country. ECOLYTE plastics are safe, economical and available today for commercial use.

H.R. 5000 is an important starting point for considering legislation in this area. However, we do recommend three areas for possible improvement. One, the Office of Recycling Research and Information also should have, as one of its major goals, the specific task of promoting the use of degradable materials where appropriate.

Two, there is already commercially available degradable technology and products that will immediately address the litter problem. As such, we feel that the timing of the implementation of the degradable portion of this legislation may well be accelerated.

And three, we recommend that you include a clearly defined process for expanding the list of regulated items which must be made from degradable materials.

I thank you again for the opportunity to submit testimony to your subcommittee and I stand ready to provide any further information that may be of assistance.

Thank you.

[The prepared statement of Mr. Dorko follows:]

**Enviromer Enterprises**

enviromer

P.O.Box 90
Leominster, MA 01453

Telephone (508) 537-9901
Telex (710) 347-1924
Fax (508) 534-3152

# Statement

of

Zoltan J. Dorko
Chairman of the Board, Enviromer Enterprises

before

The Subcommittee on Natural Resources,
Agriculture Research and Environment

With Respect to

H. R. 5000

The Recyclable Materials Act of 1988

Acknowledgement to the contribution of:

Dr. Ervin Dan - Managing Director, Enviromer Enterprises

**ECOLYTE® Degradable Plastics**

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Testimony of Zoltan J. Dorko
Chairman of the Board, Enviromer Enterprises
to the Committee on Science, Space and Technology
The Subcommittee on Natural Resources,
Agriculture Research and Environment
of the Committee of Science, Space and Technology
With Respect to
H.R. 5000
The Recyclable Materials Act of 1988

Mr. Chairman and Members of the Subcommittee:

I thank you for the opportunity to submit testimony regarding H.R. 5000 on behalf of Enviromer Enterprises, a partnership registered in Massachusetts.

Enviromer Enterprises is a joint venture between Polysar Incorporated of Akron, Ohio and the U.S. subsidiary of Eco Corporation of Toronto, Canada.

The Plastics Division of Polysar Incorporated is a major producer of polystyrene with a capacity of 0.9 billion pounds per annum. Polysar is in the process of becoming affiliated with a major manufacturer of polyethylene with a capacity of 1.2 billion pounds per annum. The Plastics Division of Polysar made a strategic decision to initiate a major thrust in environmental plastics with the mission to address issues and concerns related to plastics in the environment. Thus, Polysar brings to the joint venture expertise in the manufacture and marketing of plastics in North America.

Eco Corporation is the owner of ECOLYTE® technology which was developed at the University of Toronto, Canada. This technology is state-of-the-art for imparting photodegradability to a wide variety of plastics.

## ECOLYTE® TECHNOLOGY

### The Technology

Plastics are polymers consisting of long chains of molecules strung together. ECOLYTE® degradable plastic is a polymer with a small number of special groups, sensitive to ultraviolet light, along the chain. Ultraviolet exposure starts a sequence of reactions which causes the chains to break down into shorter and shorter units. Finally, the chains are so short that the plastic article becomes brittle and it eventually disintegrates. ECOLYTE® plastics incorporate the trigger, built at the time of manufacture, which starts degradation on exposure to sunlight. Blended with conventional resins, ECOLYTE® degradable plastic causes the disintegration of the plastic article. The rate of degradation is proportional to the level of ECOLYTE® resins. The higher the level, the faster the degradation. The processor specifies the rate of degradability according to the end use of the finished product.

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The Benefits

The key benefits of the ECOLYTE® technology include:

A. ECOLYTE® resins are a concentrate (masterbatch) and when combined with conventional plastics constitute a minor component that introduces the light sensitivity into the product. The plastics manufacturer can continue to use his current supply of raw materials to which he adds a small proportion of the ECOLYTE® product.

B. ECOLYTE® resins are not an additive. The photosensitizing component is an integral part of the molecular structure of the polymer and it will not leach out, either before or after degradation.

C. The ECOLYTE® degradation time can be controlled. The trigger for the degradation to begin is exposure to sunlight outdoors. The material is stable as long as it is indoors, even under artificial light.

D. The ECOLYTE® degradation products are harmless and inert.

E. The products are stable in landfill, are compatible with recycling and incineration, and thus, do not interfere with other waste management solutions.

F. ECOLYTE® resins can be used in all major plastics types, for example, polyethylene, polypropylene, PET, nylon, PVC, polystyrene, rubber and latex.

G. It is suitable to be used in a variety of applications, such as grocery bags, fast-food containers (clamshells), cups, plates, trays, containers, six-pack carriers, mulch film and plastic- coated products.

H. The ECOLYTE® masterbatch does not have any adverse affect on the processing of conventional plastics and has been tested in foam, extrusion applications, injection molding, oriented polystyrene film and polyethylene film.

I. ECOLYTE® resins do not adversely affect the basic properties of the plastic being modified and retain all of the desirable characteristics for which the plastic was originally chosen in these products.

J. ECOLYTE® resins are currently used commercially in Canada and Italy in a variety of applications. There is a high level of interest by manufacturers of plastic product in the United States who see a market need for degradables as a solution to the litter problem.

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## ENVIRONMENTAL PROBLEMS

We believe there are two separate but interrelated problems. These two problems are:

- Management of solid waste
- Management of litter

### 1. Solid Waste Management

There is a rapid growth in the generation of solid waste at the same time that there is decreased availability of landfill capacity, which is the major means of disposal.

The rapid growth in solid waste generation has been caused by changing lifestyles in the United States. There are more working couples and single parents who have a need for convenience in food packaging, take-out food, eating out, etc. This has led to a revolution in the packaging and distribution of food products. There is also a heightened awareness and concern for health because foodstuffs are shipped over longer distances and are expected to maintain their freshness over a longer period of time.

Plastics meets these changing needs better than any other material. There has been particularly rapid growth in the use of plastics in disposables and packaging. Because of the rapid growth in plastics usage, it is getting a disproportionate amount of attention in the solid waste problem.

The number of landfills available for disposal of solid waste has actually been decreasing because of closings by the EPA in order to eliminate hazardous waste sites. There is public opposition to the opening of new landfills in highly populated areas. There is also concern with leachates, methane gas and unpredictable settling of landfill. In addition, the need to transport municipal waste long distances is increasing significantly the cost of disposal.

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Solutions to solid waste management that are being considered include:

## Source Reduction

Because of the rapid growth in the use of plastics in packaging, there are those who advocate reducing their use by regulation. There is indeed some potential for redesign of packaging and for elimination of double-packaging at the point of sale. However, the swing to plastics has taken place because of their efficiency, durability and light weight. Replacing plastics with alternate materials would in fact increase the volume of waste by 256% and tonnage by 413% thus requiring more than double the space in landfills. In addition, energy consumption would increase by 201% and the cost of packaging by 211% (Reference: Report by the Society for Research Into the Packaging Market, Germany). It is also unlikely that the change in lifestyles required to eliminate the current trends in packaging would be acceptable to the American public.

## Improved Landfill Technology

There is a feeling among some that biodegradability is desirable in landfills. However, others argue that even food does not degrade in landfills if conditions of moisture and air availability are not right. In addition, some materials can never be made degradable. Thus, settling of the landfill can be unpredictable and uneven. Moreover, methane gas and leaching of landfill substances into the groundwater are also potential hazards. On the other hand, a predictably stable landfill can be reclaimed and used for normal land use. Thus, the desirability of biodegradable solid waste in landfill has to be evaluated further.

## Incineration With Energy Recovery

Incineration raises concerns of harmful emissions and toxic ash. There is modern technology available to control emissions and eliminate harmful air pollutants. Modern technology can also be applied to manage the disposal of incinerator ash. Incineration is, in fact, a form of recycling, in that the energy locked into plastics can be recovered to generate steam and electricity. The energy that can be released from plastics is particularly high and is often used in incinerators to improve the burning efficiency of other solid waste components.

Recycling

Recycling is seen by many as a highly desirable method of waste management. The problems associated with this method include the need to collect and separate the various components and to find markets for the recycled products. Most plastics can be readily reformed in a recycling operation. There is currently a great deal of activity in the industry to improve the technology of plastics recycling.

In conclusion, solid waste volumes will continue to grow. It is a complex problem which requires many solutions. All potential solutions have to be pursued in concert. It is not likely that one solution is adequate to address this complex problem.

## 2. Litter Management

Litter is a social problem; it is unsightly in our parks and beaches and on our streets. It is a potential health problem in that it can be unsanitary as evidenced by medical products washed up on beaches. Litter can also be a potential hazard to wildlife causing entanglement and/or ingestion leading to starvation or choking.

Litter has a number of significant sources.

- Carelessness and thoughtlessness by people who throw away refuse.
- Inadequate control of collection and disposal of solid waste.
- Illegal disposal of solid waste (ocean dumping).

Although many materials cause litter, such as paper, metals, wood and plastics, the latter is singled out due to its durability and light weight.

Potential solutions to the reduction of litter include:

- Education of the public.
- Enforcement of strong anti-litter laws.
- Enforcement of proper disposal of solid waste and improvement in collection systems.

Despite all the efforts to avoid litter, litter continues to accumulate on our beaches and streets. The answers to the management of this problem include cleaning up litter and providing products which degrade into harmless subunits when exposed to the elements. Technology to enhance the degradability of plastics is available for most types of plastics that are likely to end up as litter. A variety of these technologies are currently being commercialized.

Of all of the approaches to making plastics degradable, we believe that the ECOLYTE® technology addresses the widest range of plastics products that are likely to end up as litter. Products made with the ECOLYTE® technology are non-leachable, either before or after degradation, and do not contaminate the environment. Degradation can be controlled and is triggered by exposure to sunlight outdoors. Products made with ECOLYTE® resins do not interfere with the other potential solutions to the landfill problem. These products are now commercially available for use in polystyrene, polyethylene and polypropylene and are being developed for other plastics.

## CONCLUSIONS

There are two problems that are reaching crisis proportions in America today:

1. The rapid increase in the volume of municipal solid waste.
2. The pervasive presence of litter despite significant efforts to prevent it.

Plastics products are seen to be a major contributor to both problems because of the rapid growth in their usage and for the very attributes that make plastics the preferred material in many applications.

We have suggested that solutions to the solid waste problem include: improved landfill technology, incineration with energy recovery and expansion of current efforts in recycling.

Solutions to reducing the litter problem include enforcement of existing anti-litter laws, continuous education, clean up, and the use of degradable plastics products to minimize the impact of the litter which appears to be inevitable. Technology is commercially available today to produce plastics products which will disintegrate into subparticles which are harmless to the environment when exposed to the elements outdoors. Degradable plastics offer a solution which will significantly reduce litter without interfering with the potential solutions to solid waste management.

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It is our opinion that H.R. 5000, The Recyclable Materials Science and Technology Development Act of 1988, is timely and comprehensive. It represents a major step in addressing the pressing problems of solid waste and litter in America. We are pleased to see that your bill addresses both the solid waste and litter issues by considering recycling and degradability.

We respectfully submit that there is already commercially available degradable technology and products that will immediately address the litter problem and that the timing of the implementation of the degradable portion may well be accelerated.

We thank you for the opportunity to submit testimony to your committee and stand ready to provide any further information that may be of assistance.

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Mr. **Hochbrueckner**. Thank you, Mr. Dorko.

At this point, we'll hear from Mr. Maddever.

Mr. **Maddever**. Thank you. If you'll just bear with me a moment while I put this slide tray on—

Mr. **Hochbrueckner**. Surely.

Mr. Maddever, how long is your slide presentation?

Mr. **Maddever**. I won't take more than my ten minutes, I promise you.

Mr. **Scheuer**. Should we turn the lights off?

Mr. **Maddever**. I don't think—we may—the lights may be all right.

[Slide.]

Mr. **Maddever**. What I'd like to do is just use this to illustrate some of the points that I've highlighted in my more formal presentation, the written presentation.

First of all, let me thank you for having the opportunity to come here today and speak before you. What I'd like to do is tell you a little bit about how biodegradable plastics, particularly those that are starch-based, which seem to be the—two of the, I guess, three major producers in this area are using starch-based. The third technique will be spoken of by Mr. Lloyd and, obviously, there's starch involved in that in terms of the production and I'm sure he will identify that.

I would just like to tell you how we feel that these materials fit in with recycling, incineration and other methods of waste management.

[Slide.]

Mr. **Maddever**. First of all, we're firm believers that segregation and recycling are keys in the issue of waste management. The target areas for our materials, however, are those materials which are either not inherently recyclable, and I give you examples of things, such as garbage bags, example of a product made with Ecostar today, a starch-based biodegrading agent, shopping bags. These materials are things which are very—have very low density and are difficult to collect economically and recycle.

We're also looking at things such as diapers which may go into incineration if the problems of incineration are solved, but I hesitate to think about the job of recycling a baby diaper.

So that's a type of a product which is inherently probably going to end up in a landfill site in the near term, as long as we have landfill sites available. So, to make these materials degrade, to reduce the volume material—or the volume in the landfill site that is taken up by these materials, may have an effect on the length of life of the landfill.

[Slide.]

Mr. **Maddever**. We're also doing some work on materials which need functional degradability. That is, things like tree seedling planters, mulch film, agricultural mulch film, and also composting, and composting is addressed directly in H.R. 5000 and this is an example of a bag which is used today in Switzerland to collect household wastes specifically for composting and I think that's a very important part of H.R. 5000, that it deals with the composting of municipal waste materials.

[Slide.]

Mr. MADDEVER. This is a bag which is designed to break down in a very rapid period of time, in the order of five to six weeks, but the fact that it is a plastic bag rather than a paper bag allows the easy collection of kitchen waste and the use of a plastic-type material in the composting operation without having to separate the material by opening the bag and dumping out the contents.

So this is an example of a functional degradable material and I think is a real opportunity for the plastics industry to look at new uses for materials which are basically plastic-based. There's only about 10 percent starch in here.

Very quickly, then, incineration is an issue. Starch-based materials are carbohydrates. They will burn so they are entirely compatible with incineration, should the other problems of incineration be solved.

Photodegradation, you've heard about briefly, and biodegradation is the area that we're talking about.

Let me say that there is a significant amount of work that indicates that plastics are, in fact, biodegradable. However, this is a very, very slow process and may take in the order of several hundred years. What we are trying to do here, and I believe probably the—Mr. Dorko and his group, with photodegradable, are trying to enhance processes which already exist. Plastics do have some photodegradable characteristics already. They already have biodegradable characteristics. We are trying to enhance these properties and cause the breakdown in a more reasonable length of time.

Very, very quickly, because it's not in my written submission, I'd just like to show you what happens in a starch-based type technology. First of all, the starch is present in the plastic and it is consumed by micro-organisms.

[Slide.]

Mr. MADDEVER. If we look at a normal piece of plastic under a microscope, there's not much there.

[Slide.]

Mr. MADDEVER. We look at our material, and those are grains of starch actually present in the plastic.

Now, if we expose our normal plastic to the micro-organisms—and this is part of an ASTM test for fungal and bacterial attack, these are known as fungal spores.

[Slide.]

Mr. MADDEVER. After about six weeks, there is very little attack on the plastic. There's no growth or attachment. There's no nutrition there for the materials.

[Slide.]

Mr. MADDEVER. However, the starch-filled plastic shows a considerable amount of growth and attack on the starch, to the point at which the starch is consumed and this does two important things. It starts to fragment the plastic, and as I have said, the plastic is, in fact, somewhat degradable and it has been found that the greater the surface area, the faster this degradation reaction proceeds. Many chemical processes are similar and the higher the surface area, the faster it proceeds.

So we open up the matrix of the plastic by removing these starch particles; we also cause fragmentation of the plastic. This latter is very, very important in the case of marine environments and animal entrapment. The removal of these starch granules weakens the material and will allow an animal to break free.

We also see, in this close-up of one of the starch granules removed—we see there are bacteria—that is the foamlike substance on the surface. We can see there is also a crack in the plastic. The enzymes excreted by the micro-organisms will attack the plastic in a mild way and cause some cracking. Again, this all goes toward trying to break down the material. In the case of a landfill site, allow that garbage bag to break down and allow the environment to compost what is inside it, or in the case of a polyethlene bottle—here's an example of one which has 10 percent starch in it—to allow that bottle to collapse. There's a certain amount of air—even though it's collapsed in the landfill site, there is always a certain amount of air in there. We'd like to fragment that and have that volume of air taken up by fill. This is how a landfill site obviously fills up; it's by volume, not by the weight of material. So let's try and take up and make it as compact as possible.

Now, what we do, as well as put the starch in, is we add a second element, an auto-oxidant and this material is there to help break down the polymer. As I've said, the plastics do break down in a very slow way. We've tried to enhance surface area to speed that degradation up. We also try to add something else which will break down the polymer itself.

What happens is if we can get the polymer, which is a very long molecule in the case of polyethlene, of carbon and hydrogen, if we can break that down to very, very short fragments, those fragments will become a food source for micro-organisms and there's a considerable amount of work that has illustrated that.

If we can break the polymer down to very short lengths, we will get attacked by micro-organisms. The products of that attack will be the products of biological activity, typically carbon dioxide and water. These are the products, again, that are produced by the normal very slow degradation of polyethlene so I emphasize again what we are trying to do is speed up this ongoing process.

[Slide.]

Mr. MADDEVER. The other interesting thing we get is macrodegradation by insects. In thin films, insects will attack this film and will consume it. They are, again, fragmenting the product and this all goes towards producing a faster and faster reaction.

[Slide.]

Mr. MADDEVER. It's an environmental product. One of the difficulties expressed by the SPI and others is what about the timing of this and there's certainly a need for more investigation in terms of timing, but we know that the environmental factors are critical here so the need for standards is important.

Let me just skip over that and show you what can happen.

[Slide.]

Mr. MADDEVER. This is after 20 weeks in compost. On your left, a standard polyethlene film; on the right, a film with 7 percent starch. This film has not only been degraded on a microscopic level, but obviously, macroscopically, the insects have gotten to that.

[Slide.]

Mr. MADDEVER. This graph—if you just look at the curve called Second Generation, it's an illustration of how quickly this material has lost its strength. That is the orange shaped curve and that is the material being used in this particular environment for a composting bag. That is, again, I would say, an excellent opportunity for the plastics industry and for waste-handling in general.

[Slide.]

Mr. **Maddever**. Let me just conclude then that we think H.R. 5000 is a step in the right direction. We commend you for it.

Of particular note is the pilot project for composting. We feel this is an excellent opportunity for biodegradable materials, and we also think the other excellent aspect of the bill is that it emphasizes the need and recognizes the need to develop recycling and degradable technologies and makes provisions for funds.

Many of the recycling technologies which today are not economically feasible may well be feasible with further research and development and that may also be true for photodegradable and biodegradable materials.

Again, thank you very much for your patience. I hope this has illustrated the technology a little bit and I'd be pleased to answer any further questions.

Thank you very much.

[The prepared statement of Mr. Maddever follows:]

**ST. LAWRENCE STARCH
COMPANY LIMITED**

P.O. Box 1050, Port Credit Postal Station,
Mississauga, Ontario L5G 1E8

Telephone: (416) 274-3671
Telex: 06-961142

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## PRESENTATION TO THE SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

### I Biodegradable Plastics and Waste Management

Municipal waste can potentially be controlled by disposal or elimination through incineration, recycling or landfill. Waste improperly disposed of on the other hand creates problems of litter and animal entrapment. Plastic waste presents a major challenge to waste management due to its inherent durability and the growing percentage of the waste stream that it represents.

Biodegradable plastics can play a positive role in this area while being compatible with other waste management methods such as incineration or recycling. In addition these materials present a unique and effective solution for those materials which are improperly disposed of or for those materials which benefit functionally from degradability.

### II Definition of Biodegradable Plastics

St. Lawrence Starch has defined biodegradable plastics as those plastic materials which, by a combination of biological and chemical processes, initially show deterioration or loss of physical properties of the manufactured item. These processes facilitate a breakdown of the primary molecular structure (i.e. the polymer chains) ultimately rendering it to a state in which direct biological attack can occur.

The speed at which these processes occur depends on a number of factors such as the polymer, as well as temperature, moisture content, biological activity, and other environmental conditions.

### III The Ecostar System

The Ecostar system is typical of many degradable plastics systems and contains polymer, starch granules (the biodegradable ingredient), and a fat/fatty acid formulation which autoxidises to attack the molecular structure of the polymer. The probable mechanism consequent to soil burial or disposal in water is that transition metal salts naturally present in these environments interact with the fat/fatty acid formulation to generate peroxides which chemically attack the bonds in the plastics' molecules reducing the molecular chains to a level

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that they can be consumed by microorganisms. At the same time, the starch granules are biodegraded by the microorganisms present in the environment. The increased surface area produced by this action and subsequent fragmentation of the product enhances the autoxidation of the polymer. Other mechanisms which may play a significant role are physical damage due to the activity of the microorganisms, biochemical effects from the extracellular materials produced and increased reactivity of the more hydrophilic surface produced by the micro-organic activity.

The Ecostar system has no effect on shelf life. The degradation process only occurs when the material is placed in an active biological environment.

## IV **Biodegradable Plastics and Landfill**

Plastics entering the landfill create problems due to their inherent durability and their low density when compared to other packaging materials. While the plastics portion of the waste stream may be only 7.2% by weight, according to the plastics industry, it represents a much higher fraction by volume.

The percentage of plastic entering the stream is increasing as more and more traditional materials such as glass and paper are being replaced by plastics. The replacement of these traditional materials by plastics may offer many benefits to consumers in terms of ease of use and maintenance of product purity for example. The environment may benefit due to the lighter weight of plastics materials and an overall improved use of energy. However plastics are certainly more durable than paper and wood products and while glass may be extremely durable it is more easily and economically removed from the waste stream for recycling than plastics.

The opportunity exists at this time to develop packaging materials which have all the benefits of normal plastic packaging materials but through biodegradation will eliminate a signficant volume of waste in the landfill site.

Specific examples are as follows. The collapse of a household chemical bottle through degradation eliminates the volume of empty space enclosed by the bottle. The destruction of a garbage bag or shopping bag used for garbage not only eliminates the free volume within but allows attack of the degradable materials contained in the bag by the environment. Baby diapers which have a short life cycle take up a significant volume of space. A degradable diaper would free that volume.

The role of biodegradable plastics in a landfill site then is to eliminate some of the volume of materials in the landfill site and extend the useful life of the site.

A brief mention should be made here of those materials which benefit functionally from biodegradation. One example is agricultural mulch film which can be of benefit to farmers in increasing yield and decreasing herbicide use. Yet these films create significant disposal problems. A biodegradable or photodegradable mulch film eliminates the need for collection and disposal.

Another example of functional biodegradability is the use of biodegradeable trash bags for the collection and composting of kitchen and leaf and lawn waste. These materials comprise a large portion of the volume of materials entering a landfill site. Biodegradable bags which decompose quickly in composting environments facilitate the composting operation by providing the homeowner with a simple method of collection without using a bag which would either have to be opened and emptied at the composting site or which would cause entanglement in a shredding machine.

This system is currently being used in Switzerland for the collection and composting of household waste.

## V Biodegradable Plastics and Recycling

Recycling is one of the best ways of handling waste by merely eliminating materials from the waste stream. In the case of glass, aluminum and corrugated cardboard signficant energy savings are also obtained by recycling.

While some plastics can conceivably be recycled economically the very nature of many packaging materials makes this difficult. For example PET soft drink bottles make excellent candidates for recycling as they are readily identifiable by the consumer and made of a consistent material. Collection and transport may be costly due to their low density but useful materials such as insulating filler can be made from them.

Packaging films and other types of plastic containers pose a significantly greater problem. Their low density makes collection and processing difficult and costly while the mixture of the various plastic materials used in these goods limits the type of end products which can be made. Separation of the different materials such as polystyrene, polypropylene and high and low density polyethylene is virtually impossible at the consumer level and almost as difficult at the reprocessing level. The goods made from mixed plastic waste to date are large items such as fence posts and parking lot curbs which overcome the strength problems associated with the mixed feedstock through their inherent size.

Biodegradable plastics to date have been targeted at, and are most suitable for those materials which are difficult to recycle or by their very nature are never meant to be recycled. Plastic packaging films and many bottles fall into the first category while items such as garbage bags, shopping bags and of course diapers and feminine hygiene products will never be part of the recycling stream.

In the event that some biodegradable plastics enter the recycling stream the effect of dilution and of the sheer size of the recycled product will reduce the rate of biodegradation to insignficant if not non-existent levels even if the product is put in an active biological environment such as in the case of a fence post.

## VI Biodegradable Plastics and Incineration

The concerns over the safety and usefulness of incineration as a waste disposal method are significant and will not be addressed here. Biodegradable plastics are entirely compatible with incineration. Even the biodegrading agent, in most cases starch, which represents a small fraction of the total item is a carbohydrate and will burn. There is therefore no conflict between the two.

## VII Biodegradable Plastics as Food Packaging Materials

Since biodegradable plastics do not begin to degrade until put into an active biological environment they are entirely suitable as a food packaging material. They will not attract microorganisms which will contaminate food. One can compare these plastics which contain a small fraction of biodegrading agent, the balance being plastic, with biodegradable materials such as paper used for packaging flour, sugar and of course starch.

Even in the case of foods which may contain bacteria such as milk, the life of the food iteself is far shorter than the time required to begin degradation of the bottle.

The majority of the biodegradable plastics on the market today use components which are FDA approved for food packaging . Formal approval of the complete materials is being sought and is expected.

## VIII Biodegradable Plastics and the Marine Environment

The major issues of plastic waste in the marine enviornment are entrapment and ingestion. Public education and legislation are effective tools for reducing the amounts of these materials but total elimination is probably impossible. Improper disposal at sea and the accidental loss of plastic fishing nets will continue. Thus methods to weaken the material to avoid entrapment and finally to disintegrate the material are important tools.

Photodegradable plastics do an excellent job weakening and eliminating those materials which are floating or washed up on shore. Biodegradable plastics solve the problem for those materials which are below the surface where sunlight cannot have any effect. This is particularly true for items such as garbage bags weighted to sink and fishing nets which are caught on reefs creating an endless cycle of killing through "ghost fishing".

## IX Biodegradable Plastics and Renewable Resources

Most of the biodegradable plastics developed to date use corn starch as an additive or portion of the resin. One other material is produced by a biological process using glucose as the feedstock. All of these materials then replace a signficant portion of a non renewable resource, the hydrocarbon used to make the polymer, with abundant easily renewable resources.

In the case of the corn starch based plastics St. Lawrence has conservatively estimated that only a 10% market penetration into those products which are immediate targets, such as trash bags, shopping bags, diapers, etc., would create a market for over 2 million bushels of corn per year.

## X Research and Development

Considerable research and development is going on in this area in a number of organizations. As many of these are centered around agricultural activities, the use or redirection of research funds to develop new markets rather than increase yields of crops already in an oversupply situation, would seem to be appropriate.

Increased market acceptance of these products will of course also encourage research.

## XI Market Incentives

In recent months the interest in degradable plastics has risen signficantly. Many producers are reluctant to incur extra cost in the commodity packaging market despite the interest of the public and the willingness to pay extra for environmentally friendly products, as demonstrated in surveys.

Market incentives from the government in the form of tax reductions for recyclable or degradable materials or the impositon of taxes on materials not falling into those categories, as have been proposed or imposed by several legislative bodies, will greatly assist the development of these products. Care should be taken in the case of tax imposition to not make plastic products noncompetitive as there are many significant benefits to those products as discussed previously.

Mr. HOCHBRUECKNER. Thank you, Mr. Maddever.

We will hear from Mr. Lloyd and then we'll come back to the three of you for questions.

Mr. Lloyd.

Mr. LLOYD. Mr. Chairman, members of the committee, may I, on behalf of ICI Americas, and my colleagues, Galvin and Dr. Herrett, thank you for this opportunity to present to you the development of a natural biodegradable plastic by our company to illustrate some of the strengths and weaknesses of this material with respect to some of the issues which are being addressed here in H.R. 5000.

To briefly introduce the company, ICI Americas is the U.S. subsidiary of Imperial Chemical Industries (ICI) in London, England and we are the world's fourth largest chemical company. ICI Americas is based in Wilmington, Delaware and employs more than 19,000 people at nearly 100 sites throughout the United States, with sales of around $4 billion.

ICI Americas has a broad range of products. Some of the better known ones include Glidden paints and Mylanta antacid, but we manufacture products that serve nearly every major U.S. industry.

ICI is a company with a strong commitment to research and development. Worldwide, we spend $2 million a day on R&D and one of the products of this research is this group of natural biodegradable polyesters. These novel plastics are produced by fermentation. Their development was initiated in the late 1970s and directed towards the production of novel biological materials from natural feedstocks.

It also represented at the time a defensive measure against the threat to our traditional plastics business posed by rapidly escalating oil costs. It should be noted that ICI is a major producer of plastics, having led the development of polyethylene. We produce a quarter of all the polyester film in the world and have major engineering plastics.

We, therefore, see that these biodegradable polymers as an extension to the range of plastics are being made available to the plastics-using industry.

For simplicity, I'll refer to the polymer by its acronym PHBV, which stands for poly (3 hydroxybutyrate - 3 hydroxyvalerate). I'll describe a little more about that in a moment.

The PHBV polymers distinguish themselves by being natural. They're produced, as I say, by fermentation, using a common soil organism and are made up of units which occur widely in nature, including in the human body. They are renewable. The principal raw material is sugar, which comes from abundant agricultural products. They are truly biodegradable in that they break down safely and completely in the environment into carbon dioxide and water.

They are biocompatible. They're accepted by human tissue, where they may be used in biomedical applications and are reabsorbed safely by the body. They are readily processed. They behave like traditional plastic materials and may be formed into films and moldings and fibers by conventional technology.

It's been known for a long time, 60 years, in fact, that many bacteria and algae quite naturally accumulate polyester in their cells. The single building block of the natural homopolymer is called hydroxybutyric acid. It is, in fact, a simple fatty acid. Simple fat material. It occurs widely, as I say, in nature.

The polymer exists in the cell in discrete granules, where it provides a food store for the organism. The organism stores polyester much as we store fat. It can be regarded as a microbial fat.

In times of excess energy intake, the polymer may account for half of the cell weight. However, when needed, it can be rapidly broken down to release the energy and generate the carbon dioxide and water.

The early potential of this polymer as a plastic, however, was limited by its poor properties and expensive manufacturing process. Recent developments that we've been able to make in organism productivity and recovery and in the introduction of the copolymers, PHBV, have greatly extended the use of these materials.

The organism that we've selected occurs widely in soils. It is a soil bacterium. We grow it in conventional fermenters, much like the ones used to make antibiotics. Established technology.

We use the sugar feedstock, typically glucose, but you could use any sugar from the processing of corn or sugar beet or sugar cane. The plastic is, therefore, totally derived from agricultural feedstocks and not from oil.

By controlling the culture conditions in the fermenter, the bacteria can now be made to accumulate 80 percent of their weight as plastic. These fattened cells are harvested; the polymer is separated from the cell mass, it's filtered and dried and then is offered as a powder or a resin, just like any other plastic material.

It was the discovery that the composition of this plastic could be influenced through the nutrition of the organism that provided the breakthrough for this development. The bacterium can be made to incorporate another simple fatty acid called hydroxyvalerate to provide a family of novel copolymers, random copolymers, with the fatty acids arranged randomly in a chain.

The amount of valerate acid that you incorporate can be controlled and the properties of the plastic will vary accordingly. For example, increasing valerate content reduces the melting point, increases the flexibility and makes the material much more readily processed and offers a much wider range of application possibility.

Further work remains to be done, however, to improve the polymer harvesting technology and to categorize the property of the plastics more fully and to optimize application processing conditions. However, to date, we know that it can be used in all current manufacturing processes.

Like my colleagues, I also have bottles that demonstrate it can be formed into rigid molds, moldings, it can be made into films, into film moldings, into fibers and into nonwoven fabrics. It can be used to coat paper. In fact, all of those applications where traditional plastics are used.

The one property which distinguishes it from traditional oil-derived plastics is its biodegradability. PHBV is completely and safely biodegradable. When an article made from the polymer is placed in the soil, the natural micro-organisms simply recognize it as food.

Fungi colonize the surface, much as has been described on the starch colonization of Ecostar. They secrete enzymes. The enzymes digest the polymer back down to its simple fatty acids. They are absorbed; the organisms use them as an energy source. Carbon dioxide and water are the only products of degradation. None of the products during this process are either toxic or provide any ecological hazard.

In fact, the glucose, which was used to feed the organism initially, was itself produced from carbon dioxide and water, which means that, in effect, we have a recycling process which is described on this graphic.

[Slide.]

Mr. LLOYD. Carbon dioxide and water are fixed by photosynthesis in the field to provide corn, wheat, sugar cane, sugar beet. We extract the sugar from that, feed it to the micro-organism, extract the resin, the plastic from the micro-organism, use it in its various applications, put those products back into the environment, carbon dioxide and water are again generated, and the cycle goes back around.

The only energy put into the cycle apart from the agricultural parts is the sun. It's a fully recycling process.

Being a natural process, biodegradation is enhanced by both environmental factors—presence of moisture, temperature and the activity of micro-organisms—and by physical factors—the surface area and surface texture.

An article made from or incorporating PHBV will be totally stable in air. It does not photodegrade. It's only when the PHBV is placed in an environment of high microbial activity, like soil, or sewage or the seabed, that biodegradation occurs.

The higher the intensity of microbial activity, the more rapid the degradation. Anaerobic sewage and river estuary sediments provide faster breakdown than aerobic sewage or soil.

To give an indication quickly of the rate of degradation, PHBV film placed in the garden soil will lose three-quarters of its carbon, three-quarters of its mass as carbon dioxide within less than six months. A thin film would disintegrate in days within a sewage system.

A PHBV article finding its way into an active landfill would disintegrate within a year.

To exploit the potential of this material, ICI set up a dedicated company called Marlborough Biopolymers, which is working through ICI Americas in Wilmington with a range of potential customers in the U.S. to customize polymer processing and formulations to individual application needs.

However, the material is currently produced in England and only at a rate equivalent to hundreds of tons per annum. We are confident that the production technology is robust and capable of being expanded to an industrial scale, however it is emphasized that the project is still developmental. Because of the low production volume, the product is still highly priced. It's $15 a pound.

However, the target price for technical grade material from a full-scale plant is around $2 a pound. If you remember that current plastics generally are less than $1 a pound, you'll see that this material will still be a significant premium over bulk commodity plastic.

This means that it will first search out niche markets where—like, it can be used as a specialty material like biomedical applications and in those areas where plastic disposal and pollution control demand a biodegradable system.

It will also encourage the combination of PHBV with other materials like paper and other plastics to extend the volume and reduce the cost of the material, whilst retaining its important properties of thermoplasticity and biodegradability.

In conclusion, then, the development of PHBV polymers offers new natural materials which have many of the properties of traditional oil-derived plastics but which are made from renewable agricultural feedstocks and are environmentally benign, being safely and completely biodegradable. The current focus of the activity is the development and optimization of the polymer formulations, the processing conditions and the applications of the material as a specialty polymer and is the disposable and packaging area.

More work, however, is still needed to be done to investigate the technical and economic viability of using this material in what might be referred to as commodity plastic application. Even though current processing technologies can be utilized, the polymer can't simply be dropped into production and instantaneously used in these diverse applications. Not unlike the development of other plastics, the development and commercialization of which stretched over many decades and cost numbers of millions of dollars, PHBV will need to go through some of these development processes, too.

Its progression to date has been relatively rapid. However, more work will still need to be done.

We do recognize, as is illustrated in H.R. 5000, that biodegradable plastics will offer one option in what is otherwise likely to be a systems approach to dealing with the plastics disposal problem. This means that all technologies of source reduction, recycling, reuse and incineration, together with degradables will be applied. The technology of choice will depend not only upon the legal and technical and commercial considerations, but also upon specific application. Specific solutions for specific types of products.

The PHBV development is responding to this rapidly changing situation and the likely timeframe for commercialization of this plastic in those specific uses where its technical performance and economic performance can be readily exploited is between two and five years.

Thank you for hearing my presentation.

[The prepared statement of Mr. Lloyd follows:]

ICI Americas Inc.

August 10, 1988

STATEMENT

of

| | |
|---|---|
| Dr. Roger Lloyd | ICI Biological Products, Wilmington, DE 19897 |
| Mr. Thomas J. Galvin | ICI Americas Inc., Wilmington, DE 19897 |
| Dr. Richard A. Herrett | ICI Americas Inc., Washington, DC 20036 |

for

ICI

before

The House Subcommittee on

Natural Resources, Agriculture Research and Environment

United States House of Representatives

Regarding

BIODEGRADABLE PLASTICS

For more information contact:

Dr. D. R. Lloyd
Business Manager
ICI Biological Products
ICI Americas, Inc.
Wilmington, DE 19897
(302)575-2859

Dr. R. A. Herrett
Government Relations
ICI Americas Inc.
1600 M Street, N.W.
Suite 702
Washington, D.C. 20036
(202)775-9722

1600 M Street, N.W., Suite 702, Washington, D.C. 20036
Telephone: (202) 775-9722 Facsimile: (202) 775-9718

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## INTRODUCTION

ICI Americas Inc. welcomes this opportunity to present the development of a natural biodegradable plastic to the U.S. House of Representatives' Subcommittee on Natural Resources, Agriculture Research and Environment.

ICI Americas is the U.S. subsidiary of Imperial Chemical Industries PLC (ICI) of London, England, the world's fourth largest chemical company. ICI Americas is based in Wilmington, Delaware, employs more than 19,000 people at nearly 100 sites throughout the United States, and has sales of about $4 billion.

ICI Americas has a broad range of products. Some of the better-known include Glidden paints and Mylanta antacid, but we also manufacture products that serve nearly every major U.S. industry. Our Agrochemicals business manufactures numerous herbicides and pesticides that aid the American farmer. A drug made by our Pharmaceuticals business is the world's leading treatment for hypertension. Each day in the U.S., more than a million-and-a-half hearts depend upon Tenormin. The Glidden company's can coating technology protects the contents of eight out of every ten canned drinks in the United States. Our advanced materials are used by the U.S. Navy in helicopter seats and one of every two cars made in the U.S. use Tribol lubricants, produced by our Specialty Chemicals division.

As you can see, ICI Americas is a company with a broad scope and with a strong commitment to research and development. ICI worldwide spends over $2 million a day on R&D and more than 50% of this in the life sciences - pharmaceuticals, agrochemicals, biological products. One of the products of this research is a group of natural, biodegradable polyesters.

These novel plastics are produced by the fermentation of simple sugars like glucose. Their development is the result of the collaborative research activities of the plastics and biotechnology groups of ICI. This work was initiated in the late 1970's and directed towards the production of novel biological materials from natural feedstocks. It also represented a defensive measure against the threat to the traditional plastics business posed by the sharply escalating oil costs.

The plastics are referred to by the acronym PHBV, which stands for poly (3 hydroxybutyrate - 3 hydroxyvalerate).

The PHBV polymers distinguish themselves by being:

| | | |
|---|---|---|
| Natural | - | produced in fermentation by a common soil microorganism and made up of units which occur widely in nature including in the human body. |
| Renewable | - | the principal raw material feedstock is sugar derived from such abundant agricultural products as corn, sugar beet or sugar cane. |
| Truly biodegradable | - | broken down safely and completely by environmental microorganisms to carbon dioxide and water. |
| Biocompatible | - | compatible with human tissue where they may be used in surgical applications and be slowly reabsorbed by the body. |

Readily Processed - behave like traditional plastics and may be formed into films, moldings and fibers by conventional technology.

The following describes the development and current status of PHBV commercialization.

## HISTORY

It has been known for more than 60 years that many bacteria and algae accumulate the polyester poly (3-hydroxybutyrate) - PHB. The single building block for this homopolymer, hydroxybutyric acid, is a simple fatty acid which occurs widely in nature. The polymer exists as discrete granules within the cell where it is thought to provide a food store for the organism. These microorganisms store polyester much as humans store fat.

In times of excess energy intake, the polymer may account for more than half the dry weight of the cell. However, when needed, it can be very rapidly metabolized and within a few hours 90% of it will be used up by the organism. It is broken down by the cell's own enzymes and metabolized to release the stored energy.

The polyester was first characterized in 1925. It has been shown to be a thermoplastic material often misleadingly compared to polypropylene which has some similar properties. The early potential of the homopolymer PHB was limited by its poor thermal properties and a complex manufacturing process. However, recent advances in the production technology made by ICI have increased organism productivity, improved and simplified product recovery and introduced the range of PHBV copolymers with improved properties and processability.

## PRODUCTION

The microorganism selected by ICI for polymer production is the safe, naturally-occurring soil bacterium Alcaligenes eutrophus. This is grown in conventional fermenters on a sugar feedstock, usually glucose derived from corn or wheat starch. Molasses or other sugar rich streams from the corn, sugar beet or cane processing industries may also be used. The plastic is therefore derived from agricultural feedstocks, not from oil.

By controlling the culture conditions, the bacterium can now be made to accumulate up to 80% of its dry weight as polymer. These "fattened" cells are harvested, and the water insoluble polymer is released by rupturing the cell wall. It is separated from the cell mass, filtered and dried in what is now a much simplified and lower cost process. It is then sold either as a powder or resin chip and, from this point, is handled like a traditional plastic.

The discovery that the composition of the polymer could be influenced through the nutrition of the organism during fermentation provided a real breakthrough. The bacterium can be made to incorporate hydroxyvalerate, another widely occuring, natural fatty acid, to provide the novel family of random PHBV copolymers; i.e., polymers made up of the two fatty acid building blocks in random sequence. The amount of valerate incorporation can be controlled and the properties of the copolymers will vary with the varying valerate content.

## PROPERTIES AND PROCESSING

PHB homopolymer is a stiff and somewhat brittle material which melts at 350°F, but, unfortunately, decomposes at slightly higher temperatures. The introduction of valerate leads to a reduction in melting point such that a copolymer containing 25% valerate melts at 280°F whilst the decomposition temperature remains roughly the same. PHBV is also a much more ductile, flexible material with improved processability allowing much wider applications for the plastic.

Further work remains to be done to improve the polymer harvesting process and to categorize fully the properties of the plastic and its optimum processing conditions. To date, however, we know it will lend itself to current manufacturing practices. For example, PHBV can be melt or solution processed. Successful extrusion and injection blow moldings have been achieved with standard machines. Foamed moldings may be obtained using nitrogen or chemical blowing agents. Strong oriented single or multifilament PHBV fibre has been obtained by conventional spin-draw techniques and the material can be formed into a cotton wool-like floss or non-woven fabric. Thick and thin films are made by standard film making processes. A tough biaxially oriented film has now been produced and thin films can be laminated on to paper or card.

However, the key properties which distinguish PHBV from traditional synthetic plastics are its biocompatibility and biodegradability.

## BIODEGRADATION

PHBV is completely and safely biodegradable. When an article made from the polymer is placed in soil, the natural microorganism population recognizes it as food. Fungi in particular colonize the surface and secrete enzymes which digest the polymer. The products of this digestion are absorbed and metabolized yielding carbon dioxide and water. None of the products of this degradation process offer any toxic or ecological hazard. PHBV, therefore, recycles completely and safely back into nature. As the glucose which provided the original feedstock for the production of PHBV is synthesized by plants from carbon dioxide and water, this represents in theory a closed cycle with sunlight being the prime energy source. PHBV in effect recycles back into nature and offers a truly renewable plastic.

Being a natural process, biodegradation is enhanced by environmental factors - the level of microbial activity, moisture, temperature - and it is influenced by chemical and physical factors - particularly surface area and surface texture.

An article made from or incorporating PHBV will be totally stable in air. It is not photodegradable. It is only when the PHBV article is placed in an environment of high microbial activity, like soil, sewage or the sea bed, that biodegradation occurs. The higher the intensity of microbial activity, the more rapid the degradation. Anaerobic sewage and river estuary sediments provide faster breakdown than soil or aerobic sewage and, as it is a surface phenomenon, the greater the surface area exposed to microbial attack, the faster the breakdown. A roughened surface will provide more rapid microbial colonization and also speed up the process.

To give an indication of the rate of degradation, a PHBV film placed in garden soil will lose three quarters of its carbon as carbon dioxide within six months. A thin film would disintegrate in a few days in sewage treatment plant whilst a typical PHBV bottle in an active landfill could be expected to disintegrate within a year. PHBV articles which find their way into waterways will tend to sink, as the polymer is denser than water, and will then degrade in the bottom sediment.

## CURRENT STATUS

To exploit the potential of PHBV, ICI set up a subsidiary company named Marlborough Biopolymers Ltd. (MBL) in 1983. MBL is a small entrepreneurial organization which participates in a number of collaborations to develop commercial applications for the polymer. The activity is determinedly market led, with MBL working through ICI Americas in Wilmington, Delaware with its potential customers the U.S. to customize polymer processing and formulations to individual application needs.

Production and sale of PHBV have grown with demand. Material is currently produced in Billingham, England at a rate equivalent to 100's of tonnes per annum. We are confident that the production technology is robust and capable of being expanded to full industrial scale. However, it is emphasized that the project is still in the developmental stage and the rate of progress towards full commercialization will be greatly influenced by the rapidly changing legislative, commercial and consumer attitudes to the role of biodegradability in responsible plastic disposal.

Because of the low production volume, the product is still highly priced at $15/pound. However, the target price for technical grade material from a full scale plant is around $2/pound. This is still more expensive than bulk commodity polymers which indicates that the material will first search out niche markets as a specialty polymer and those applications where control of plastic disposal and pollution demands a biodegradable system. It will also encourage the combination of PHBV with other materials, for example paper and other plastics, to extend the volume and reduce costs whilst retaining the important properties of thermoplasticity and biodegradability. One point to remember, however, is that this material comes essentially from the agriculture sector and is unhinged from the supply or price of oil. If oil prices increase again relative to sugar prices or should PHBV be produced in those parts of the world where carbohydrates are abundant and oil imported, then the differential between this natural polymer and petro polymers will narrow.

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## CONCLUSION

The development of PHBV polymers therefore offers new, natural materials which have many of the properties of traditional oil-derived plastics, but which are made from renewable agricultural feedstocks and are environmentally benign, being safely and completely biodegradable.

The current focus of PHBV activity is in the development and optimization of polymer formulations, processing conditions and applications both as a specialty polymer in the biomedical area and in the disposables and packaging sectors. More work is needed to investigate the technical and economic viability of using PHBV in what might be referred to as commodity plastic applications. Even though current extrusion and blow molding technologies can be utilized, the polymer cannot simply be dropped into production in the many and diverse applications requiring disposable plastics. This is not unlike the history of other plastic polymers the development and commercialization of which stretched over many decades and cost millions of dollars. PHBV's progression to its current status has been relatively rapid, by comparison. However, as noted, more work has yet to be done in cost reduction, polymer characterization, applications development and in our understanding of the role of biodegradable products in the changing world of plastic waste management.

Biodegradable plastic offers one option in what will most likely be a "systems approach" to dealing with the plastic disposal problem. This means that all technologies of source reduction, recycling, reuse, incineration and degradables will be applied. The technology of choice will depend not only upon legal, technical and economic considerations, but also upon the specific application and geographic location.

The PHBV development is responding to this rapidly changing situation and the likely time frame for commercialization of the plastic is 2 to 5 years.

**Mr. Hochbrueckner.** Thank you very much.

As you know from the bells, another vote has been called and the chairman has left—he has left me to sprint to make it, where he's going to walk more leisurely.

Let me suggest this to you. I think it would probably be most appropriate at this point if we closed the meeting—finished the meeting—but what we will—what we would like to do is to submit questions to you and hold the record open for two weeks in terms of putting your answers in.

But let me just ask two quick questions before I sprint to the vote.

Are all three of your companies in the SPI, in the Society for—

**Mr. Lloyd.** Yes.

**Mr. Dorko.** Yes.

**Mr. Maddever.** Yes.

**Mr. Hochbrueckner.** You are, okay.

And also, I assume, based on the presentations that all three have made that essentially you support the mandating of degradability with regard to fast-food packaging, shopping bags and six-pack holders, certainly at the five-year point, and perhaps even sooner, I would assume, based on what you've said.

It seems to me the products that you were talking about that are either biodegradable or photodegradable are, from your point of view, essentially available now and an earlier mandate would probably be acceptable from your point of view. Is that true?

**Mr. Dorko.** Yes.

**Mr. Maddever.** Yes.

**Mr. Lloyd.** Yes. In our case, the product really isn't available at the moment. It's still developmental and I think we would still need to confirm that in the various applications where it might be used, it, in fact, performs technically and provides an economically viable option.

**Mr. Hochbrueckner.** Very good.

Well, let me thank you formally for being here and sharing your valuable time with us and your inputs.

We will be submitting these questions to you for response within two weeks and I greatly appreciate your time and I do apologize for the many interruptions, but that is the nature of the business. Thank you very much and this hearing is adjourned.

[Whereupon, at 12:25 p.m., the subcommittee was adjourned, to reconvene subject to the call of the Chair.]

# APPENDIX I

## QUESTIONS AND ANSWERS FOR THE RECORD

**ST. LAWRENCE STARCH**
**COMPANY LIMITED**

P.O. Box 1050, Port Credit Postal Station,
Mississauga, Ontario L5G 1E8

Telephone: (416) 274-3671
Telex: 06-961142

September 6, 1988

Mr. James H. Scheuer
Chairman
Subcommittee on Natural Resources
Agriculture Research & Environment
Committee on Science, Space & Technology
388 House Annex 2
Washington, D.C.
20515

Dear Mr. Scheuer:

Thank you for the opportunity to testify before the Subcommittee on Natural Resources, Agriculture, Research & Environment on H.R. 5000 and for this opportunity to provide further response to the questions sent to us recently in your letter of August 19, 1988.

I hope that the enclosed will assist the subcommittee in their efforts. Please feel free to contact me if I can make any further contribution.

Yours very truly,

W. J. Maddever

W. J. MADDEVER
MANAGER-BUSINESS DEVELOPMENT

Established 1889

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## QUESTIONS FOR THE RECORD

### SUBCOMMITTEE ON
### NATURAL RESOURCES, AGRICULTURE & ENVIRONMENT

### BILL HR-5000 - SEPTEMBER 7, 1988

1. Is your Degradable Plastic safe for use in plastic to come in contact with food?

All of the components of the Ecostar system are either food products such as the corn starch and also the corn oil used as oxidant, or are products which are already approved for food contact. St. Lawrence Starch is proceeding with a petition to the FDA to have the complete formulation approved. It is our belief that their are no technical obstacles to this and this approval will be forthcoming in the due course.

2. As your plastic degrades, are pollutants released into the environment?
What is the potential for the degradation products to contaminate ground water?
What are the final degradation by-products?
Please describe the testing & research conducted on this point by the industry and by other researchers. Should the Federal Government be involved in evaluating degradable plastic by-products for environmental safety?

The Ecostar system merely enhances the already existant but very slow degradation of plastics such as polyethylene. The products of degradation are merely those products which will be produced eventually by this very slow process. The initial products of degradation are the fragments produced by the weakening and facturing of the plastic article. As the degradation process for Ecostar based products is a biological process, the final products of degradation will be the products of biological activity particularly carbon-dioxide and water. Thus, neither the early products of degradation nor the final products would be expected to contaminate ground water.

Several researchers have examined the biodegradability of common plastics. Among these was a paper produced by Potts and Glendinning of Union Carbide and published by the National Technical Information Service. A.C. Albertsson of Sweden has studied the biodegradability

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of polyetheylene by measuring the carbon-dioxide produced during the degradation process. Other researchers have examined biodegradability by measuring oxygen up-take during the process. More current work includes studies by St. Lawrence Starch of Mississauga, Ontario, Canada; Archer Daniels, Midland, Decatur, Illinois, USA; and Agri-Tech, Gibson City, Illinois, USA; for their respective starch based biodegradable plastics. A large scale study at the University of Missouri will also be under way in the near future. St. Lawrence is also conducting programmes at the University of Surrey in the United Kingdom and with the Roxxo group of Switzerland.

The Federal Government may wish to examine degradable products under the current standards for landfill operations. Materials from St. Lawrence and ADM are currently being evaluated under an EPA priority pollutants test. As there are many standards and tests in existence, it would seem appropriate that degradable plastics simply meet the requirements of these standards with regards to environmental safety.

3. Are your degradable products partially available now and can they be applied to a wide range of polymers?

Ecostar based products have been produced in the United Kingdom for approximately 15 years. They are seeing wide spread use in both Europe and North America at the present time. Current uses include grocery bags, merchandise bags, garbage bags, compost bags, blow moulded bottles for household chemicals and motor oil. The plastics can be used in all forms of polyethylene as well as polypropylene, polystyrene and polyvinyl chloride.

4. Can the initial time of and rate of degradation be controlled?

Ecostar based products do not begin to degrade until they are exposed to an active biological environment such as that present in a landfill site. They are no more degradable on the shelf than such items as the paper packaging used to contain such items as flour and sugar. In fact, plastic packaging using Ecostar may in fact be a superior material to those. The rate of degradation can be controlled through the amount of active elements such as the starch and oxidant added to the plastic. However, since the process is a biological one, the environment in which the plastic is placed will have a major role in the rate of degradation for any formulation.

5. Is their a need to develop uniform standards for degradability?

As degradable plastics will be exposed to a number of environments, it is impossible to set standards that will cover all of the situations. However, there is a necessity to develop some bench mark test methods so that in that uniform environment, product A may be compared to product B, and an acceptable rate of degradation in that environment can be established. Hopefully this comparative method will be easily extrapolated into the various environments that the plastics will see in real life. There are several test methods available now through the National Bureau of Standards and the ASTM which may be useful in setting standards for degradable plastics. I believe that the ASTM is examining this issue at the present time.

6. Are your degradable plastics compatible with other solid waste management solutions such as landfill, incineration and recycling?

Ecostar degradable plastics have been developed with landfill operations in mind. The gradual degradation and collapse of materials made with Ecostar can extend the life of the landfill site by reducing the volume of these materials. The materials are compatible with incineration as the additional components such as starch and corn and soya bean oil will burn harmlessly in an incineration operation and not detract from the energy input. While Ecostar based plastics are targeted at those markets and products which are not easily recycled, such as diapers and plastic film, the addition of Ecostar into the recycling stream will not cause any problems of compatibility. Currently plastics recycling is faced with the incompatibility of mixed plastic waste. That is, different polymers such as polyethylene, polypropylene and polystyrene are not easily blended. As a result the current products of recycling are very large items such as parking lot curbs and fence posts. The addition of Ecostar to these materials would cause no more loss of strength than that produced by mixed plastic feedstream and the Ecostar would be so diluted so as not to cause problems by making things such as fence posts biodegradable.

7. What are the present market impetements to greater usage degradable plastics? Why has the US market been slower to adopt degradable plastics than other countries?

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Degradable plastics result in some increase in costs, typically in the order of 10%. Market surveys have shown that the public, when informed of the availability of degradable package materials, is fully prepared to pay an additional 10%. However at the plastics industry in general have been difficult to convince. Industry organizations and major resin companies have mounted an anti-degradable plastics campaign, which has confused many manufacturers in the industry as to whether the products are beneficial or not. It is our opinion that the market place will eventually dictate whether these products are useful and affordable. We believe that the US market has been slower to adopt degradable plastics than other countries because the waste issue has been slower to reach the critical stage due to the much larger land mass and availability of space for disposal in the United States than, for example, Europe.

8. Are there any technical reasons why all one use disposable plastic products could not be made either photodegradable or biodegradable?

In our opinion, there is no technical obstacle to manufacturing one use disposable plastic products out of photo or biodegradable materials or both. In fact, these particular types of products, are the key targets for products such as Ecostar, since many of them are not recyclable from either a technical or economic point of view.

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**Envìromer Enterprises**

enviromer

P.O.Box 90
Leominster, MA 01453

Telephone (508) 537-9901
Telex (710) 347-1924
Fax (508) 534-3152

September 21, 1988

James H. Scheuer, Chairman
U.S. House of Representatives
Committee on Science, Space,
and Technology
Suite 2321
Rayburn House Office Building
Washington. D.C. 20515

Dear Sir:

Thank you for your letter dated August 19, 1988.

Due to vacations I am late in responding to the questions that you posed for the record, for which I apologize.

Attached are the questions, and my answers. I trust that this will be useful.

Very truly yours,

Enviromer Enterprises

Zoltan J. Dorko

Zoltan J. Dorko
Chairman

ZJD/sf

ECOLYTE® Degradable Plastics

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## QUESTIONS FOR THE RECORD

1. Is your degradable plastic safe for use in plastics that come in contact with food?

2. As your plastic degrades, are pollutants released into the environment? What is the potential for degradation byproducts to contaminate groundwater? What are the final degradation by-products? Please describe the testing and research that has been conducted on this point by the industry and by other researchers. Should the Federal government be involved in evaluating degradable plastic by-products for environmental safety?

3. Are your degradable products commercially available now, and can they be applied to a wide range of polymers?

4. Can the initial time and rate of degradation be controlled?

5. Is there a need to develop uniform standards for degradability? If so, should the Federal government (through, for example, the National Bureau of Standards) play a role in setting standards?

6. Are your degradable plastics compatible with other solid waste management solutions such as landfill, incineration, and recycling?

7. What are the present market impediments to greater use of degradable plastics? Why has the U.S. market been slower to adopt degradable plastics than other countries?

8. Are there any technical reasons why all one-use, disposable plastic products could not be made either photodegradable or biodegradable?

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## ANSWERS FOR THE RECORD

1. ECOLYTE degradable plastic is safe because the active ingredient is not an additive but a part of the polymer backbone and it will not leach out in contact with food.

2. As the plastic degrades there is no harmful pollutants released. The plastic degrades into subparticles of inert plastic which are harmless to the environment. Independent evaluation according to EPA protocol showed degradation products to be harmless. Federal government should require the supplier to provide data.

3. ECOLYTE degradable plastics are currently commercially available in polystyrene and polyethylene and soon in polypropylene. Development is underway to introduce commercial products in other plastics such as polyester (PET), rubber and latex. ECOLYTE technology is the only one that covers this wide range of materials.

4. The initial time is controlled by the exposure to sunlight outdoors - normally when the article becomes litter. The rate of degradation is controlled by the amount of ECOLYTE plastic that is incorporated into the product as well as by the design of the product.

5. Laboratory standards would be helpful to predict the behaviour of certain products on exposure to the elements. The NBS could play a role in developing standard tests. However, the rate of degradation of final products will depend on the size and shape of the product and then the manufacturer of the product must test his product and satisfy himself that it will degrade in a timely fashion.

6. ECOLYTE degradable plastics will not interfere with other solid waste management solutions such as landfill (it is inert and will not create instability, will not form gases or release toxic chemicals) incineration (no toxic gases) and recycling (can be stablized with additives). Some degradable technologies may not be as inert as ECOLYTE plastics and each will have to be evaluated individually.

7. Few suppliers are willing to incurr even a small additional expense to impart degradability when others do not. Unfortunately it must become a requirement by law before all suppliers will add this feature.

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8. There is no technical reason why all end-use products could not be made photo degradable. The ability to make some end-use products biodegradable may be impaired today because existing commercial technology is not available which does not alter the properties of biodegradable plastics and use of some biodegradable technologies might not be applicable to food contact applications.

ZD/sf

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**ICI Americas Inc.**
Wilmington
Delaware 19897
Telephone (302) 575-3000
Telex 4945649
Fax (302) 652-8836

September 1, 1988

J. H. Scheuer, Chairman
Subcommittee on Natural Resources,
Agriculture Research, and Environment
U.S. House of Representatives
Committee on Science, Space, and Technology
Suite 2321 Rayburn House Office Building
Washington, DC 20515

Dear Congressman Scheuer:

I am responding to your August 19 request for a written response to various questions which was directed to my colleague, Dr. Roger Lloyd.

Both Dr. Lloyd and myself would be very willing to further discuss the issues raised in the questions should you or members of the Subcommittee staff wish to do so. We can be reached on 302-575-3000 or 800-456-3669.

Thank you very much for including ICI Americas Inc. in the debate surrounding this important issue.

Sincerely,

T.J. Galvin

Thomas J. Galvin
New Ventures

TJG:alh
Attachment

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A member of the ICI Group

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## Questions for the Record

1. Is your degradable plastic safe for use in plastics that come in contact with food?

ICI's biodegradable polyester, PHBV™, is currently not F.D.A. approved for use in food packaging. However, the necessary toxicological testing is well underway and have proved very encouraging to date. The completed test results are expected to be submitted to the F.D.A. for clearances by 1991.

2. A. As your plastic degrades, are pollutants released into the environment?

PHBV, under normal degradation conditions, will not release pollutants into the environment.

B. What is the potential for degradation by-products to contaminate groundwater?

PHBV degradation products are not harmful to the environment and will not contaminate groundwater.

C. What are the final degradation by-products?

The ultimate degradation products are carbon dioxide and water.

D. Please describe the testing and research that has been conducted on this point by the industry and by other researchers.

A number of European and American firms have active development programs underway with PHBV. End use applications include:

- sustained drug release
- sustained pesticide/herbicide release
- orthopedic pins, plates and joints
- a variety of bottle applications
- film applications that range from disposable diaper cover stock to food packaging.

ICI itself has done an extensive and expensive amount of process and product development work dating back to the early 1970's. This work has concentrated on the production of in specification, quality polymer. However, over this time frame, a library of information is available in areas such as:

- rates of degradation in various media; i.e., water, sea water, esturine sediment, activated sludge, etc.
- rates of degradation in vivo
- effect of molecular weight on physical properties
- effect of polymer composition on physical properties and degradation rates.

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This work is ongoing and has been expanded as the result of the recent surge of interest in biodegradable plastics.

E. Should the Federal government be involved in evaluating degradable plastic by-products for environmental safety?

The Federal government should not be involved in evaluating degradable plastic by-products for environmental safety, but should be involved in setting standards. (See #5)

3. Are your degradable products commercially available now, and can they be applied to a wide range of polymers?

ICI currently produces a range of biodegradable polyesters. These polyesters are made up of repeating units of hydroxy butyric acid and hydroxy valeric acid. The current range of products have hydroxy valeric acid contents that range from 0 to 20%.

All of ICI's biodegradable PHBV polyester resins are currently available for sale at a price of $15 per pound. These resins can be further processed into finished articles ranging from stiff, tough bottles to flexible films.

Further developments of the process, the product, and its applications together with an increase in the scale of production of the polymer are expected to reduce this price significantly.

4. Can the initial time and rate of degradation be controlled?

PHBV polyesters will only degrade when placed in the soil, in esturine sediment, sewage sludge, etc. The degradation rate in these environments will be dependent upon a number of factors such as moisture content, temperature, surface area exposed, etc. Generally, as the moisture, temperature and surface area exposed are increased, the degradation rate will increase in turn.

A point to emphasize is that PHBV is indefinitely stable in the open air. Therefore, no degradation will occur on the supermarket shelf or in the normal home atmosphere.

5. Is there a need to develop uniform standards for degradability? If so, should the Federal government (through, for example, the National Bureau of Standards) play a role in setting standards?

There is a crying need for uniform standards for degradability, as well as standards for monitoring and measuring degradation by-products (see 2E). The National Bureau of Standards should be involved in not only setting such standards, but should become involved with other appropriate Government and Industry bodies in establishing reliable, consistent test methods for degradability and products of degradation.

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6. Are your degradable plastics compatible with other solid waste management solutions such as landfill, incineration, and recycling?

PHBV biodegradable polyesters are completely compatible with both landfilling and incineration. In the area of recycling, PHBV polyesters as well as other degradable plastics may not be completely compatible dependant on the end-use of the recyclable materials. However, if as suggested by the industry, a form of plastic coding in initiated, this should not have a major effect on recycling. Further, the technical effect of mingling degradable plastics with non-degradable plastics in a recycling operation will be minimal relative to the overall technical effect caused by the co-mingling of a variety of plastic types in the same recycling process.

7. A. What are the present market impediments to greater use of degradable plastics?

The current plastic products seen in the marketplace are the result of many man years of effort and billions of research dollars. The current need for degradation was not seen as a desirable property during this development process. Accordingly, the necessary production processes, physical properties, toxicological profile, etc. of currently available degradable systems are not fully developed and will not be fully developed for a number of years.

Also - current non-degradable plastic items are produced in multi-million ton plants to satisfy the market demand. These large plants, using processes developed over the years, produce plastics at very low costs and the finished goods are sold at reasonably low prices. The available degradable systems, on the other hand, are made in smaller volume plants and prices are therefore higher than non-degradable systems. Given this disparity in price, plus not having the product profile refined to the depth non-degradable systems are, the end user is reluctant to switch to a higher priced, relatively non-proven material.

B. Why has the U.S. market been slower to adopt degradable plastics than other countries?

To our knowledge, the U.S. market has not been slower to adopt degradable plastics versus other countries. However, it is apparent that the U.S. is definitely behind Europe and the Japanese in both recognizing the overall problem with municipal solid waste and in taking actions to alleviate it. From our perspective, this ex-U.S. effort has not singled out a single entity of the waste stream, such as plastic, nor has it concentrated on a single solution, such as degradability. Rather, a total systems approach involving incineration, recycling and degradability has been brought to bear on the total waste stream and, very obviously, the results are impressive.

8. Are there any technical reasons why all one-use, disposable plastic products could not be made either photodegradable or biodegradable?

As each item will have different physical requirements and different physical forms (e.g., films, foam, or solid injection moldings), it is unlikely that in the short to medium term (2-5 years), all one use items could be made either photodegradable or biodegradable. Further, many of the one-use items entail food contact and will need the necessary F.D.A. clearances. Time necessary to complete the detailed food testing required plus the time necessary to pass through the F.D.A. procedures may possibly stretch this into a long term (5-10 years) effort.

TJG:alh
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**The Society of the
Plastics Industry, Inc.**

SPI

1275 K Street, N.W., Suite 400
Washington, D.C. 20005
(202) 371-5200

September 13, 1988

Chairman James H. Scheuer
Subcommittee on Natural Resources,
Agriculture Research, and Environment
Committee on Science, Space,
and Technology
U.S. House of Representatives
Room 388, House Annex 2
2nd and D Streets, SW
Washington, DC 20515

Dear Chairman Scheuer:

I am pleased to provide responses to your questions submitted to SPI August 19:

1. Has SPI done any studies, or are you aware of any studies, which would demonstrate that photodegradable or biodegradable plastics are safe for contact with food?

   **At this current stage of development, each of the photodegradable plastics and the biodegradable plastics are proprietary products being developed by a single company or by "licensees" of a single company. Most are still in the product/market development stage. SPI has not conducted any studies to determine the acceptability of any of these proprietary products -- that is up to the individual producers. SPI is not aware of any studies which the individual producers may have performed.**

2. Has SPI done any studies, or are you aware of any studies, which would demonstrate that photodegradable or biodegradable plastics are safe to use with other solid waste management solutions such as incineration, recycling and landfill?

   **As above, SPI has not conducted any studies and has no knowledge of any studies conducted by producers on the safety of photodegradable plastics or biodegradable plastics in solid waste management solutions. However, SPI sees no technical reason to question the safety of either type of degradable plastic in incineration. The effect of degradable plastics on the recycling of plastics is unknown at this time. Photodegradation does not occur in a landfill, and the rate of biodegradation in landfills of all materials, plastics included, is not well known at this time. (Repeat 60% degradable, but still landfill crisis).**

3. Has SPI done any studies, or are you aware of any studies, which would indicate that pollutants are released to the environment, including groundwater, from photodegradable or biodegradable products?

**Again, SPI has not conducted any studies and has no knowledge of any studies which would indicate that pollutants are released to the environment from photodegradable or biodegradable plastics. SPI would note the concerns that currently exist about the ground water contamination by leachate, and the gaseous emissions from landfills, and questions the desirability of requiring additional materials to degrade.**

4. Two degradable plastics that are currently in production (Ecolyte and a starch-based biodegradable plastic made by the St. Lawrence Starch Co.) were discussed at the hearing. Are you aware of any harmful effects to the environment or to human health that would come from using these new technologies now?

**As above, SPI has no knowledge of the environmental effects or fate of these proprietary products.**

5. Does SPI consider any degradable plastic safe to use at this time?

**The photodegradable ring connector for beverage cans and similar containers has been in use for 13 years in several states. SPI is unaware of any adverse environmental impact attributable to this product.**

6. Is there a need to develop uniform standards for degradability, or can each company simply provide its own substantiation for its performance claims? If SPI believes standards are appropriate, should the Federal government (through, for example, the National Bureau of Standards) play a role in setting standards?

**There is a clear need for the development of standards for photodegradable and biodegradable plastics -- and for other materials as well. SPI believes that the National Institute of Standards and Technology (formerly NBS) should play an active role by participating in the current efforts of the American Society for Testing and Materials (ASTM) to develop such standards.**

7. Are there any technical reasons why all one-use, disposable plastic products could not be made either photodegradable or biodegradable?

**Plastic materials are chosen for applications, including one-use, disposable applications, by matching the material with the particular physical and chemical requirements of the particular**

application, as well as the technical requirements for the manufacturing process. Each proprietary photodegradable or biodegradable material must be evaluated in each application, considering its individual manufacturing and product performance requirements.

As noted in the answer to question 1, most photodegradable or biodegradable plastic materials are still in the product/market development stage.

Sincerely,

Margaret Rogers
Director, Federal Government Affairs.

# APPENDIX II

## ADDITIONAL MATERIAL FOR THE RECORD

Testimony of the Honorable Sherwood Boehlert of New York
before the House Subcommittee on
Natural Resources, Agriculture Research and the Environment
Wednesday, August 10, 1988

MR. BOEHLERT: Mr. Chairman, let me take this opportunity to commend you for your leadership in bringing attention to a grave matter facing our country. As a nation, we are faced with an impending crisis. While many in America choose to look the other way, I, for one, appreciate the fact that you and the members of this Subcommittee have chosen not to look the other way. I congratulate you on your foresight in choosing to attack this problem right now.

Mr. Chairman, we're facing a garbage crisis. While our country is just now beginning to wake up and smell the trash, many of our states are already up to their ears in the stuff. Consider this: The state of New York alone will export some 1.1 million tons of trash this year. Where will it go? To land fills in the Midwest. Why? Because New York has no room left to bury it. We've increased our export of garbage by 44 percent in just two years.

But New York is not the only state facing this crisis. As a nation, we bury 200 million tons of trash each year. The EPA tells us that 27 states will be hit with this crisis by the year 1992. In the past 5 years, we closed over 3,000 landfills nationwide. In a nutshell, we have no place left to bury our trash.

Last year at about this time, Americans kept tally on the number of days New York's unlucky garbage barge had to cruise the seas with its cargo looking for a place to dump its load. The barge's daily travels and travails would have been humorous had they not been symptomatic of something so tragic. After many months and thousands of miles, the garbage barge helped America come to a sobering conclusion -- nobody else wants our garbage either.

It is time to face the facts. In the convenience of our prepackaged, throw-away lifestyles, who has stopped to ask, "Where does all this trash go?" The end to our trash problems do not lie at the curb where we leave our own disposables twice a week. Unfortunately, our trash problems do not even end at the county dump any longer. The fact is, at this rate our trash problems are not going to end.

Under your leadership, Mr. Chairman, we are now taking the hard step of facing these facts. Together with my colleagues on our bill, HR 5000, we have begun to provide solutions. The bill represents the first bipartisan effort at the federal level to deal with the nation's trash through recycling. The approach is not novel--many communities across the country have already implemented similar plans at the local level. However, the scope of our legislation is novel.

Our legislation would present national guidelines for minimizing the country's trash. HR 5000 would tackle this problem from two angles.

First, it directs the Commerce Department to establish an Office of Recycling Research and Information, to fund research into this technology, and to spread available information. The Commerce Department will also come up with an overall plan for managing the nation's trash recycling efforts.

Second, the bill will institute a Consumer Product Recycling Program. In conjunction with the EPA, the Commerce Department will identify and list consumer goods for which recycling is feasible and will require that they then be recyclable. Any products exempted from this list must be composed of biodegradable materials. After 5 years of enactment of this legislation, the sale of certain consumer goods which are not recyclable, biodegradable or photodegradable will be prohibited. Naturally, certain items will be exempted for reasons of national security or absolute neccessity.

Once again Mr. Chairman, I commend your leadership on this issue. And I commend the leadership of my colleagues supporting this bill. As the rest of America begins to turn its attention to this problem, it will be important that we already have procedures in place to head off the coming crisis. Some will be slow to recognize the problem. Most of us however, already smell it for what it is. Ours is a good approach--proven at the local level all around the country. It is now time for federal policy to fall in step. We have a solid blueprint for that policy.

Thank you very much.

-end-

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AUG 11 1988

STATE OF NEW YORK
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

THOMAS C. JORLING
COMMISSIONER

AUG 11 1988

Dear Congressman Hochbrueckner:

Thank you for affording us a chance to share our views on your sponsored bill entitled, The Recyclable Materials Science and Technology Development Act (H.R. 5000).

It was gratifying to note that you utilized the recommendations we offered back in May, when we were given the opportunity to review and comment upon your earlier version of the bill. The use of the word biodegradable in place of degradable and the strengthening of the Department of Commerce's charge relative to ensuring market development for recycled products, we believe, add to the bill's far-reaching positive effects. The fact that your bill also carries a $10 million appropriation sufficient to get the job done is commendable.

As stated in my letter of May 9, 1988 to you, your bill is the kind of legislation that is sorely needed at the national level to maximize benefits while avoiding any negative impacts on any one state's industry.

In closing, I want to reemphasize that New York State strongly endorses your far-reaching bill, because if enacted, it should greatly reduce the current amount of waste we are generating while at the same time maximizing recycling throughout the country.

Sincerely,

Tom Jorling

Thomas C. Jorling

The Honorable George J. Hochbrueckner
U.S. House of Representatives
1008 Longworth House Office Building
Washington, D.C. 20515

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NFEC
NORTH FORK ENVIRONMENTAL COUNCIL, Inc. EST. 1972
*a non-profit organization for preservation of land, sea, air and quality of life*

CORPORATE MAILING ADDRESS
P.O. Box 311, Southold, N.Y. 11971
President: Ronnie Wacker
Secretary: M.E. Tomaszewski

MEMBER SERVICE & INFORMATION
Route 25 at Love Lane – P.O. Box 799
Mattituck, N.Y. 11952
(516) 298-8880

July 22, 1988

The Honorable George J. Hochbrueckner
Member of Congress
House of Representatives
Washington, D.C. 20515

Dear Mr. Hochbrueckner,

Thank you for sending us the information on your proposed bill H.R. 5000. We support your effort mightily. We are, as are so many other municipalities, facing a critical point in the disposal of our waste materials in our local dump and an act such as you suggest will be enormous support for this community in starting its own recycling collections.

It seems so reasonable to follow a path such as you suggest but there is enormous resistance to changing our "throw-away" attitudes in this country. But we must change and your bill should be a spur in bringing change about.

Please keep us informed of the progress of your bill; we will do what we can to give it publicity and support in our small community here. And, if you have some suggestions as to how we might be of use in your efforts on this matter, please let us know.

Sincerely yours,

Ronnie Wacker

Ronnie Wacker
President

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Office of the Provost
State University of New York at Stony Brook
Stony Brook, New York 11794-1401
telephone: (516) 632-7000

**StonyBrook**

August 2, 1988

The Honorable George J. Hochbrueckner
Member of Congress
1008 Longworth House Office Building
Washington, D.C. 20515

Dear George:

Thanks a lot for the copy of your bill, H.R. 5000. I am delighted that you are taking a leadership role on promoting recycling. It is not only important to Long Island, but to the entire nation and it needs some strong envisionary heros. It is an excellent bill and I will do anything I can to help you implement it. Please let me know when and if you can think of anything that I might do to be helpful to you. One of the big problems is going to be developing and sustaining markets for recycled materials. I don't believe we've fully appreciated how difficult this is going to be. On the other hand, when one considers the avoided costs, you don't even have to break even to make a profit. Another element which I would like to see is to nurture companies (industries) that would take recyclable materials and convert them back into new products. One could view that shipping paper and other items off to Japan, China and other countries is recycling -- or at least an alternative to disposal -- but I believe if we could stimulate the development of industries here in the United States to utilize these materials, we would be far better off.

Good luck with your bill. Let's get together sometime this summer. Good luck this fall. With all best wishes.

Sincerely,

J.R. Schubel
Provost

JRS:ga

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**BELLAND**
**INCORPORATED**

**20 ACORN PARK, 20/340**
**CAMBRIDGE, MA 02140-2390**
**TEL: 617/864-5770**

October 3, 1988

Mr. Michael Rodemeyer
HOUSE SCIENCE & TECHNOLOGY SUBCOMMITTEE
ON NATURAL RESOURCES
Room 388
House Office Building Annex #2
Washington, DC 20515

Dear Mr. Rodemeyer:

This letter is in follow-up to the information which we sent to you August 2, 1988 for the subcommittee meeting held in August. Since we have had difficulty reaching one another on the telephone, I thought a letter at this time would be appropriate.

Belland's main concern regarding the pending federal legislation has to do with the terminology used to describe degradable plastics. Belland's materials do not fall under the term "biodegradability," nor "photodegradable." These unique materials are chemically degradable, which allows them to be recycled easily or simply dissolved in solution for discharge in municipal waste water streams. I am sure then, that you can understand our concern when we see legislation stating that products must be "biodegradable" or "photodegradable" as our materials are neither of these.

Since no one technology by itself can answer the problem of plastics pollution, we expect that many technologies together can help to improve the situation. And we believe that Belland's technology has a very important place, particularly with respect to recycling. Our country has developed systems to recycle many of our natural resources, particularly paper and glass. Though plastics recycling is still in its infancy, Belland's materials are important for the future because the plastics themselves are engineered to be recycled without difficult technology or major investments.

We would appreciate your comments on the information we have sent to you. In addition, I would enjoy speaking with you regarding the work of your committee and how it will affect Belland. I will call you within a week to speak with you further on this matter.

Sincerely,

M. F. Bouzianis/cc

Melissa Farrah Bouzianis

cc: L.J. Willey - BELLAND INC.

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